INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

IRELAND

2007 Review

OECD

INTERNATIONAL ENERGY AGENCY

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- To maintain and improve systems for coping with oil supply disruptions.
- To promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations.
- To operate a permanent information system on the international oil market.
- To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use.
- To assist in the integration of environmental and energy policies.

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The European Commission takes part in the work of the OECD.

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TABLE OF CONTENTS

Tables and Figures

TABLES

FIGURES

Figure 1

Map of Ireland

Source: IEA.

EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

Ireland's energy policy has progressed significantly since the last in-depth review in 2003. Increases in renewable energy, the replacement of old oil-fired stations by gas-fired generation, and the opening of a large combined heat and power (CHP) plant and two new efficient peat-fired power stations have contributed to the security of electricity supply, while the development of new gas infrastructures, such as the pipeline to the west, have given more areas of Ireland access to gas. With regard to market reform, the transition period from 2000 to 2007 of the Irish electricity market is about to end, with the introduction of a new market framework from November 2007, when the single electricity market covering the entire island becomes effective. Ireland conducted a successful allocation exercise in the first National Allocation Plan (NAP) for the EU Emissions Trading Scheme (EU-ETS), implementing the spirit as well as the letter of the EU directive. In energy research and development (R&D), a survey of Irish energy R&D capabilities has laid the foundations for the development of a sustainable R&D activity focusing on the needs of Irish energy policies. Finally, at the end of 2006, the government published a Green Paper on energy policy, followed by a White Paper published in March 2007. All of these are very commendable developments. The government has recently accelerated the policy development process by taking steps, in all of the major energy policy areas where action is required, towards ensuring that Ireland will have a secure and sustainable energy future. Nevertheless, the Irish government still faces serious challenges.

Energy security and energy prices are becoming major concerns for Ireland, owing to the increasing reliance on gas in the economy and the absence of sufficient domestic reserves. Electricity and gas prices have increased rapidly, giving rise to concerns about the competitiveness of Irish enterprises. To reduce the exposure of the economy to energy price increases, significant efforts have been made by the government to broaden the fuel base and to increase energy efficiency. To preserve fuel diversity, the government decided in 2004 to invest in emissions abatement technology at the Moneypoint coal-fired power station as an alternative to converting it to gas-firing. This decision removed a significant option to reduce greenhouse gas emissions set out in the 2000 National Climate Change Strategy and obliged Ireland to consider alternative approaches to reducing greenhouse gas emissions in order to meet its Kyoto Protocol commitments, including the purchase of additional

allowances through the Protocol's flexible mechanisms. Investigating alternative possibilities to achieve these reductions, such as participation in clean development mechanism (CDM) projects, may result in more cost-effective options for the government, the use of which could support the development of important skills in the area of sustainable energy.

Market reform in Ireland progressed slowly during the transition period, which began in 2000 with the introduction of a regulator and with the initial moves to develop competition. While Ireland still does not have a daily electricity market, and the dominance of the incumbent supplier (the Electricity Supply Board, ESB) has only slightly been reduced, the end of the transition period in the electricity market is now coming closer, with the introduction of the all-island single electricity market (SEM) from November 2007. The SEM will launch a set of fundamental reforms to the Irish electricity market, which were held off until its start. It will be based on a daily market, and an all-island transmission system operator (TSO). Both of these features, together with the further reduction of ESB's dominance, will lay the foundations for increased competition in the electricity market, and will amplify the competitive pressure on the incumbent ESB. The drive towards a more competitive market is also supported by the regulator's decision at the end of 2006 to force divestment of the price-setting plant owned by ESB. Reforms in the gas market have progressed less, with Bord Gáis Éireann (BGE) remaining dominant. Unbundling is planned to coincide with full market opening in July 2007. The regulator will need to make every effort to ensure that the appropriate conditions are in place to facilitate and support competition in the gas market.

Natural gas use is rapidly growing in Ireland, in particular in electricity generation and in the tertiary sector. Considerable investment in natural gas transportation infrastructure has taken place, and more is planned for the future. The government should continue to support the development of the natural gas market by creating an investor-friendly framework, thereby encouraging the entry of competitors to BGE.

Ireland has made good progress in creating a more energy-efficient economy, driven partially by structural change, and partially by real increases in efficiency of use. However, significant challenges remain to reduce the rapid increase of energy consumption in the transport and tertiary sectors, especially the very high dependence on oil. This increase in efficiency has not been sufficient to prevent Ireland's energy demand growing by over 63% between 1990 and 2005. It will be important for the government to continue to focus on further efficiency increases, particularly in the tertiary and transport sectors, over and above those achieved through structural change, and to continue to encourage energy users to become more efficient. Sustainable Energy Ireland (SEI) is the institution created to achieve these goals. It will be necessary to ensure that SEI is appropriately resourced and structured, and able to cope with the challenges it will face in implementing energy efficiency programmes in the coming years.

Following a stop to new wind farms being connected for network safety reasons from 2003 until 2005, a substantial increase in the capacity of wind generation took place in 2006. This increase is expected to continue, owing to very high interest from developers, and the favourable economics of wind generation in Ireland. Building on this commendable development, Ireland's 2006 Energy Policy Green Paper announced ambitious targets of 30% renewables in electricity consumption by 2020. Ireland is also supporting thermal use of renewables in biomass co-firing, solar thermal and biomass heating, as well as the development of biofuels for the Irish transport market. Developing new forms of efficient storage solutions and cost-effective dispatchable renewables capacity will be crucial to the government's ability to deliver its ambitious programme. While pursuing these commendable goals, continued cost-effectiveness of renewables in Ireland should be ensured by the government and the regulator.

In the area of oil and gas production, the full potential of the Irish petroleum province is still subject to doubt, given the absence of a major find. The government has faced difficulties with the local population's acceptance of the Corrib gas development, which has delayed the construction of the onshore elements and thereby the opening of the field. At the same time, production from the Kinsale field has declined further. Although the government has taken important measures to increase the interest of oil and gas developers in Ireland, such as carrying out increased research into its potential for discoveries and making information about this potential available to developers, a stable policy framework is also required. While the current fiscal regime is creating a favourable environment for developers, great care should be taken not to increase the risk for developers at this point in the development of the industry by tightening the rules.

Substantial progress has been made in peat use with the commissioning of two modern, high-efficiency peat-fired power stations, leading to the closure of all the old stations. The latter will eventually have the possibility to convert partially to biomass co-firing, enabling Ireland to increase fuel diversity in electricity generation. Also, substantial investment into the modernisation of the Moneypoint coal-fired plant will be made. These are commendable developments in the fossil-fuel sector, which will ensure diversity of fuel use in the future.

As for R&D, Ireland conducted a survey establishing capabilities and activities in energy R&D in 2004, thus laying the foundations for the development of R&D activities. This is commendable. It will now be important for the government to address the shortcomings found in the survey, to ensure that the Irish R&D institutions are able to contribute as required to address the challenges facing Ireland in the renewables and other energy sectors.

KEY RECOMMENDATIONS

The government of Ireland should:

- *Continue work on energy policy development and the implementation of the policies suggested in the Energy Policy White Paper, in particular the policies on market reform and the all-island energy market. To achieve these reforms, it will be critical to leave the energy regulator, the Commission for Energy Regulation (CER), as much independence as possible, and to ensure that the capacity of policy making and implementing institutions is increased so as to be able to meet the demands put on them. The development of a road-map for implementation would be useful in this regard.*
- *Ensure that the demand side is given adequate weight in the policy debate, by focusing resources and communication on increasing efficiency of the Irish economy, and by introducing strict norms and standards. This should include a particular focus on reducing the very high and increasing oil dependence of the Irish economy.*
- *Focus on the development of grid integration solutions for renewables in Ireland, to enable the high interest in renewables to become reality, while reducing the cost to the electricity consumers associated with the significant increase planned for renewables.*

GENERAL ENERGY POLICY

In March 2007, the government published an Energy Policy White Paper *Delivering a Sustainable Energy Future for Ireland*, as a comprehensive action-based energy policy framework covering the period to 2020. It contains over 200 actions focused on delivering a range of strategic goals to underpin the sustainability, security of supply and competitiveness of the Irish energy sector and on driving delivery with integraded structures and strong policy capabilities.

This in-depth review of Irish energy policy was written before the publication of the White Paper. Accordingly, it does not examine the White Paper in a substantive way, because of the time frame for review and the comprehensive nature of the Paper itself. This review sets out a number of findings and recommendations for the governement to consider according to its own time scales. The White Paper contains a comprehensive, consistent and mutually reinforcing package of measures, actions and targets across the three pillars or Irish energy policy: sustainability, security of supply and competitiveness. The approach adopted deserves general support.

COUNTRY OVERVIEW

Ireland has a population of 4.1 million of which slightly more than 1.7 million reside in the greater Dublin area. Outside Dublin and the central eastern region of Leinster, the country is sparsely populated, with the major centres being Cork, Limerick and Galway on the southern and western coast. The island is shared by the Republic of Ireland and Northern Ireland (NI), which is part of the United Kingdom (UK). Ireland is bounded on the west and south by the Atlantic Ocean, on the east by the Irish Sea and on the north by NI.

Total land area is slightly below 70 000 km^2. The climate is temperate maritime, strongly influenced by the North Atlantic Current. It consists of mild winters and cool summers with a relatively high degree of humidity throughout the year. Snowfall is rare, and temperatures rarely drop below freezing point.

Ireland's economy has expanded rapidly since 1990. From 1994 through 2001, gross domestic product (GDP) growth averaged 8.9% per year, followed by a slow-down in 2002-03. Since then, growth has increased again. The long period of rapid economic growth has led to almost full employment, turning

Ireland from an emigration to an immigration country, and to a rapid increase in wealth. Ireland now ranks as one of the wealthiest OECD countries. Public debt has reduced, and the government finances are in balance, thanks in particular to strong tax income from a booming housing market, and continuing support from European structural funds. This performance is largely believed to result in part from government policies favouring business activity – including a decrease in both corporate income taxes and barriers to international trade – as well as telecommunications deregulation. Much of the increased economic activity over the last decade has been in information technology, services and pharmaceuticals. Irish GDP per capita is now above average for EU countries. On 1 January 2002, Ireland adopted the euro as its currency.

The government is a coalition of Fianna Fáil and the Progressive Democrats, and has been in office since the 2002 general election. A general election is due to take place by mid-2007.

ENERGY SUPPLY AND DEMAND

Ireland is highly dependent on energy imports, including oil. Oil contributes a rising share of energy supply, and has increased its dominance as a fuel in Ireland's supply mix since 1990 (see Table 1). This growing dependence is driven by rapidly increasing oil consumption in the transport sector. Since 1990, gas use in Ireland has also grown, leading to increasing import dependence, as the only domestic gas supply source has continued to decline, and the opening of supply from the Corrib field, which was discovered in 1997, has been delayed.

The Irish economy has become more exposed to world oil and gas markets as a consequence of these developments, and this has led to rapid increases in energy prices in recent years. Growth in energy demand is forecast to be 2-3% per year out to 2020, with continued heavy dependence on imported fossil fuels and a need to invest in energy infrastructure. The government's energy forecast to 2020 indicates that the need of the Irish economy for oil and gas will not decrease, even though there will be some change in the relative importance of the two fuels between now and 2020.

Ireland is producing peat, which is used for electricity generation and heating purposes. Its peat resources are expected to last another 15 to 20 years at current production rates. Other forms of energy produced in Ireland are renewables, in the form of wind electricity generation, and the use of biomass for heating, electricity generation and, in the future, for transport fuels. While the production of these renewable fuels is currently relatively small, the government plans to increase its renewables substantially between now and 2020 (see box on The Energy White Paper).

The Energy White Paper

In October 2006, the government published an Energy Policy Green Paper, *Towards a Sustainable Energy Future for Ireland*, the first comprehensive government consultation paper on all aspects of Irish energy policy published since the mid-1970s. The visit of the IEA review team to Dublin took place during the consultation period and the Green Paper is referenced throughout this report.

In March 2007, the government published an Energy Policy White Paper *Delivering a Sustainable Energy Future for Ireland*. Among the key recommendations highlighted in this review, which the White Paper has addressed with specific actions and targets, are the following:

- A long-term road-map for the achievement of the policy goals
- An integrated, long-term strategy to achieve an optimal mix of renewable resources in power generation;
- Further market-based mechanisms in the energy sector;
- The creation of the all-island energy market;
- A regulatory framework adequate for an efficient oversight of electricity markets;
- Regular review of the Irish energy policy direction and implementation monitoring;
- Increasing public awareness on the specific energy challenges, such as security of supply, sustainability, renewables and market reform.

The publication of the White Paper and the specific actions and targets contained in it provide such a long-term road-map. Among the relevant actions and targets impacting on the above are:

- A substantial commitment to increase the development of renewable energy, detailed in a National Bioenergy Action Plan published alongside the White Paper, with individual targets for the electricity, heat and transport sectors;
- Structural change in the electricity sector in support of competitiveness, the interests of consumers and the economy, including the transfer of ownership of the transmission assets to EirGrid, the independent transmission system operator;
- Developing, jointly with Northern Ireland authorities, the all-island energy framework, with the single electricity market (SEM) to come into operation in 2007;
- A review of the regulatory regime once the SEM is operational to ensure that it will continue to meet the evolving energy policy challenges;
- Provision for regular review of the White Paper targets every two years, with a fundamental review of the energy policy framework every five years;

- A comprehensive integrated whole-of-government approach to the overall delivery of the White Paper actions, including:
  - Strengthening the national capability in the energy policy field, with research a key focus;
  - Best-practice engagement on energy policy issues on an ongoing basis with all stakeholders, including consumers and the media.

Table 1

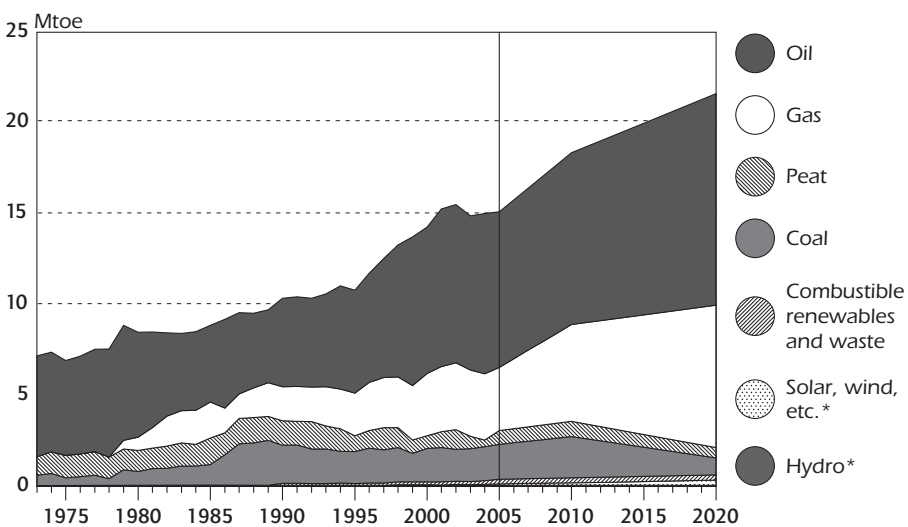
Oil and Gas Dependence in the Irish Economy in %, 1990 to 2020

	1990	*2005*	*2020*	*Change 1990/2005*	*Change 2005/2020*
Oil/Energy Supply (TPES)	47.0	58.2	53.5	24%	-8%
Gas/TPES	18.1	24.1	28.8	33%	20%
Total Oil & Gas TPES	*65.1*	*82.3*	*82.3*	*26%*	*0%*
Oil/Energy Consumption (TFC)	51.9	65.8	63.9	27%	–3%
Gas/TFC	12.5	10.4	14.8	–17%	42%

Sources: IEA and government submission.

Figure 2

Total Primary Energy Supply, 1973 to 2020

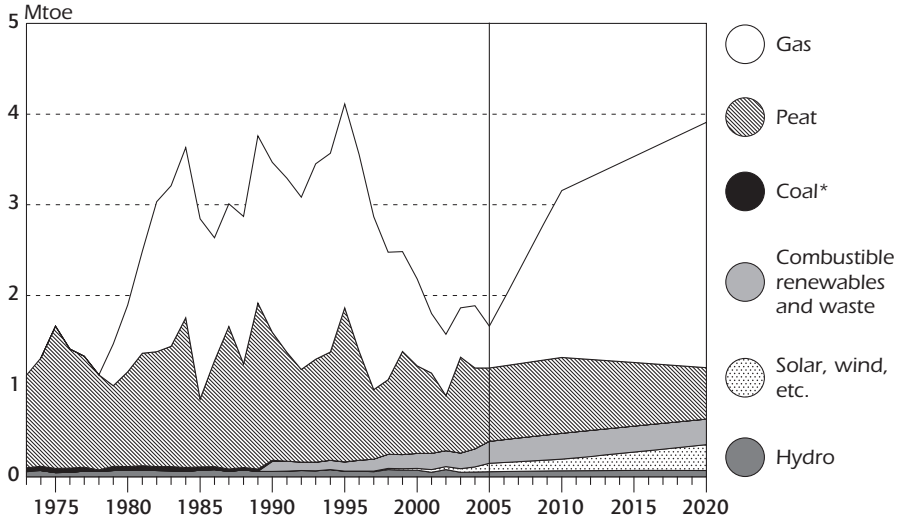


* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

Figure 3

Energy Production by Source, 1973 to 2020



* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

ENERGY POLICY

PRINCIPLES AND OBJECTIVES

Ireland's very limited indigenous energy resources shape government policy to exploit its existing peat and renewable energy resources, particularly wind, to as great an extent as possible. Irish energy policy acknowledges the high level of import dependence and supports measures to strengthen the competitiveness and integration of international energy markets. Recent dramatic increases in oil and gas prices and volatility in the geographical regions of supplier countries are seen as a threat to maintaining secure energy supplies at competitive prices. Ireland's relative geographical isolation within the European Union (EU) has led the government to support measures to increase the integration of European energy markets, including stronger UK-Ireland interconnections, stronger north and south interconnections within the island, and the development of closer links with producer countries outside the EU.

Balanced regional development is another objective, since economic growth has not occurred evenly across the country, with some regions, particularly Dublin and its hinterland, experiencing rapidly growing population, employment and output, while other regions have significantly lagged behind.

SECURITY OF SUPPLY

The Minister for Communications, Marine and Natural Resources has an overarching policy formation role in relation to promoting the continuity, security and quality of supplies of gas and electricity. The independent regulator, the Commission for Energy Regulation (CER), has been given broad statutory functions in relation to security of supply in line with EU directives. EirGrid, the independent transmission system operator (TSO) monitors the adequacy of generating capacity over time and reports to the CER accordingly. The minister's consent may be required by the CER in taking certain actions with respect to measures to protect the security of supply, such as the use of public service obligations.

The high level of dependence on imported fossil fuels means that maintaining diversity in fuels for security of supply is challenging. The government's response to small market size has been the development of the all-island project and interconnection with Northern Ireland and Great Britain. Maximising the size of the market in an all-island context is viewed as the logical first step towards the development of a regional market. This has implications for both security of supply and for competitiveness and choice in the energy market. In a situation where Ireland does not have large-scale hydro resources and where nuclear power is not an option (see box), the development of renewable energy is a critical component of creating further diversity in its fuel sources. Along with increased energy efficiency, this development forms the backbone of maintaining the sustainability of energy production and use.

Maintaining fuel diversity in electricity generation is a key challenge for Irish energy policy. Natural gas has significantly increased in the share of fuels for electricity generation[1], and looks set to increase further over the coming decade. Maintaining coal and peat in the electricity generation mix and increasing the penetration of renewables are therefore essential strategies in ensuring diversity. The government has approved a EUR 368 million retrofit of the coal-fired Moneypoint generating station to help meet the significant emission requirements, since coal is a choice for diversification. The possibility for extending the use of coal in the fuel mix is dependent on technological development, and will be kept under review by the government. To ensure diversity, the Electricity Regulation Act of 1999 allows the Minister for Communications, Marine and Natural Resources to direct the CER to impose public service obligations (PSOs) on electricity licence holders in relation to the following:

- Security of supply.
- Regularity, quality and price of supplies.

1. Gas in electricity generation increased from 28% in 1990 to 51% in 2004, before declining again to 45% in 2005 owing to high gas prices.

- Environmental protection, including energy efficiency and climate protection.
- Use of indigenous energy sources.

Nuclear Power

The Electricity Regulation Act 1999 precludes nuclear generation in Ireland. The 2006 Energy Policy Green Paper, *Towards a Sustainable Energy Future in Ireland*, states that the statutory prohibition of nuclear generation will be maintained. While acknowledging that the costs of nuclear fuel are relatively low and stable, the Green Paper believes that the capital, operation and maintenance costs of nuclear power stations are considerably greater than those of fossil fuel plants and that these costs have increased with growing concerns about operational safety and security.

The Green Paper refers further to the additional costs involved with long-term storage of nuclear waste and the costs of decommissioning nuclear power stations at the end of their useful operating life. The Paper raises serious doubts as to whether the addition of a large baseload nuclear unit into a small-island market with limited interconnection would be desirable from either a system reserve or running regime perspective. Finally, the Green Paper refers to the problem whereby nuclear waste disposal in general remains unresolved around the world, while fears of terrorist action have increased.

The Irish government therefore intends to maintain the statutory prohibition on the use of nuclear power for electricity generation. In its view, for reasons of security, safety and economic feasibility (and especially taking into account operational, capital, maintenance, waste storage and decommissioning costs), nuclear generation would not be an appropriate choice. This position was confirmed in the Energy Policy White Paper.

To date PSOs have been imposed in relation to the use of peat-fired generation and the provision of temporary short-term peaking capacity for reasons of security of supply. In addition, PSOs underpin the national programmes[2] to support the construction of additional renewables-powered generating capacity which contributes to environmental protection and source diversification.

2. The Alternative Energy Requirement (AER), which was succeeded by the Renewables Feed-In Tariff REFIT.

Bringing the Corrib gas field into production in 2009 will have the effect of supplying up to half of Irish gas needs from indigenous supplies well into the next decade. This, combined with the use of peat and renewables, would mean that about half of the fuel for electricity generation would be sourced domestically. The government will also continue to encourage investment in oil and gas exploration, and is committed to realising the commercial potential of its existing oil and gas offshore resources.

Security of gas supply has been enhanced with the completion of the second gas interconnector with Scotland, and the ability to use distillate as an alternative fuel in power generation offers a backup strategy, albeit for very short periods. The UK has become a net importer of natural gas and an issue of concern is that Ireland will become increasingly dependent on natural gas sourced from more distant markets. Access to liquefied natural gas (LNG) through the UK will also open different market sources and supply pathways for gas. An alternative to procuring LNG from the UK may be offered by the recently announced plan of Shannon LNG, an Irish subsidiary of Hess LNG Limited, to build a EUR 400 million LNG receiving terminal on the Shannon estuary with a projected capability of serving up to 40% of the Irish gas market. The government has commissioned a study to assess the medium- to long-term security of supply on an all-island basis, including the scope for a common approach to gas storage and LNG.

The government's overriding priority is to ensure that the energy supply-demand balance is always maintained. Specific policy action has been taken in the areas of gas, where additional import capacity was made available; electricity, where PSOs are used to ensure fuel diversity and efficiency measures to reduce peak demand; and oil, where Ireland is overcomplying with the IEA's stockholding requirements. Further details can be found in the relevant chapters.

MARKET REFORM

Ireland's small energy market, its peripheral position in Europe and exposure to sustained high global oil and gas prices, pose particular challenges in terms of competitive energy costs. At present competition is open for all consumers in electricity, and in approximately 85% of the gas market. By mid-2007 the Irish gas market will be fully open. The current market structure in gas and electricity is heavily regulated with limited development of competition. In electricity, the absence of independent generators in the market has raised concerns about the security of electricity supply in the immediate and medium term, because of a lack of investment. In the gas market, the full extent of unbundling of transmission and distribution from supply has not yet been implemented. However, the process is well advanced and is scheduled for completion by 1 July 2007.

One of the major factors identified as a barrier to market entry in electricity is the perceived and actual dominance of the Electricity Supply Board (ESB), arising from the ownership of a large and diverse portfolio of plants, particularly price-setting plants. This reinforces the case for embarking on a process of structural change in the electricity sector. Enhanced security of supply, reductions in controllable costs and a more dynamic energy market will create opportunities for all present players and potential investors, including those in the renewable energy sector. While competition in generation will not affect the price impact of imported fuels, it will drive improvements in operation and maintenance costs, productivity, availability, flexibility and innovation.

The government has stated that it does not favour the fragmentation or privatisation of the ESB, believing that it is important to retain it as a strong, commercially viable company. It believes that strategic electricity assets should be retained in state ownership for the long term, but that the need for significant investment in power generation in the near term presents the opportunity to deliver meaningful competition. The government also intends to retain the other two major state-owned energy companies, namely Bord Gáis Éireann (gas) and Bord na Móna (peat), in state ownership.

ALL-ISLAND ENERGY MARKET

A co-ordinated approach to all-island energy policy (north and south) is set in the context of continuing co-operation between both governments on common energy issues. Co-operation between the north and south on energy matters takes place under the auspices of a Joint Steering Group (JSG) established by the ministers in July 2003. The group comprises senior officials from the DCMNR and the Department of Enterprise, Trade and Investment (DETI) and the offices of the two regulatory authorities, namely the Commission for Energy Regulation (CER) in the south and the Northern Ireland Authority for Energy Regulation (NIAER) in the north.

Following the signing of a memorandum of understanding in August 2004 between the CER and NIAER, the respective ministers published the All-Island Energy Market Development Framework describing their policy commitment in November 2004. The framework outlined short- to medium-term objectives in infrastructure, trading arrangements and investment, dominance and market power, sustainable development, legislative and administrative regulation, and retail market design. The Joint Steering Group was given responsibility for overseeing the implementation of the all-island energy market while the regulators were assigned joint responsibility for managing the implementation. The framework also provided a high-level development programme.

The creation of an all-island energy market will bring benefits to the island as a whole, including a larger single market with competitive energy prices; open competition at all levels in the market and for all energy sources, including renewables; more stable and attractive investment location; greater security of supply; integrated infrastructure; improved energy efficiency; longer-term savings through rationalisation of functions in regulation, system operation and transmission asset planning, and improved organisation of energy research through the emergence of an all-island network of academic and industry expertise.

Single Electricity Market

The key priority for the government and the regulator is to have an all-island wholesale electricity market in place in 2007. In March 2005, the two regulators jointly published a draft paper on market design and, following a process of consultation, they published a decision paper in June 2005 on the high-level principles that will govern the operation of the market. In addition, the two transmission system operators signed a memorandum of understanding concerning their intention to jointly establish the single market operator. The introduction of the single electricity market (SEM) will not of itself address the issue of ESB's dominance, particularly in relation to price-setting ability, although recent regulatory action may have addressed this issue adequately. There are also challenges to be addressed in both markets if the benefits of competition, transparency and consumer choice are to be delivered. A reduction in ownership concentration and ability to exercise dominance in electricity generation should send firm signals in relation to progressive structural change in the electricity sector, north and south. Barriers to effective competition on both sides need to be removed through policy as well as regulatory actions.

Other Energy Co-operation

While the two regulators have been concentrating their resources and efforts on the main priority of delivering the SEM, their focus will next turn to gas issues in line with the objectives set out in the framework paper.

There is an ongoing programme of north/south co-operation in the sustainable energy area. The two administrations are in agreement on the need to respond collectively to the common economic and environmental challenges facing the island of Ireland and to plan for sustainable energy supplies through 2020 and beyond. In July 2005 the two ministers launched a preliminary consultation paper on an all-island "2020 Vision" for renewable energy with the aim of developing a long-term joint Ireland/Northern Ireland strategy for the renewable energy aspects of the all-island energy market. The consultation process identified that further information was required on the resource potential for different renewable electricity technologies in the island

of Ireland in 2020, the extent to which partially dispatchable and non-dispatchable generation can be accommodated, network development options and the economic implications of the policy options outlined within the paper. This led to the establishment of an all-island grid study comprised of four work streams to investigate the renewables resource issues for 2020, carry out modelling, and inquire into both the network development options and the economic impact and benefits of various renewable generation levels. Most of these work streams are now under way and the results of the study are expected to be published before the end of 2007.

Plans are in progress to construct a second 300-MW 400-kV North/South electricity interconnector. When operational, this second interconnector will more than double the existing power transfer capacity between north and south, facilitate increased trade in electricity and further enhance security of electricity supply and competitiveness. The government has also agreed to the construction of a 500-MW undersea electricity interconnector with the UK. Both of these new interconnectors are expected to be in operation by 2012.

ENERGY INSTITUTIONS

The three principal bodies responsible for the formulation and delivery of the government's energy policy are the Department of Communications, Marine and Natural Resources (DCMNR) at central government level, the independent Commission for Energy Regulation (CER) and Sustainable Energy Ireland (SEI), which advises the government on a range of energy and sustainability issues and delivers a number of relevant RD&D programmes.

Energy policy co-ordination within the context of wider government policies is handled by the Inter-Departmental Climate Change Team, which deals with issues such as emissions trading, chaired by the Department of the Environment, Heritage and Local Government (DoEHLG); the Renewable Energy Development Group chaired by the DCMNR; and the Ministerial Bioenergy Taskforce. The latter Task Force achieved its short-term goal of formulating a Bioenergy Action Plan which was published in March 2007. Energy issues, which have direct cross-departmental impact or are to be considered by government, are usually discussed by a Wider Energy Group of senior officials chaired by the Department of the Taoiseach (the Irish prime minister) as part of a Cabinet Committee structure. Ultimately, policy co-ordination is achieved through collective Cabinet decision-making at government level. There is a particular emphasis placed on a "whole-of-government" approach to energy issues.

GOVERNMENT DEPARTMENTS

The Department of Communications, Marine and Natural Resources (DCMNR) was formed in June 2002 as part of the reorganisation of government departments that followed the May 2002 general election. DCMNR has lead responsibility for all the energy policy matters, which previously belonged to the former Department of Public Enterprise. The DCMNR's energy activity is carried out in the following five divisions:

- Electricity and gas regulatory policy, including legislation on electricity and gas market liberalisation and sectoral regulatory policy and corporate governance responsibility for CER.
- The State's shareholder and corporate governance roles in relation to the ESB, the state-owned electricity generator and supplier, and North/South Co-operation, including the all-island market project.
- The state's shareholder and corporate governance roles in relation to Bord Gáis Éireann, the state-owned gas pipeline and supply company; Bord na Móna, the state-owned peat company; EirGrid, the state-owned independent electricity transmission system operator; together with oil stockholding obligations and contingency planning;
- Renewable energy, energy efficiency and corporate governance responsibility for Sustainable Energy Ireland (SEI).
- Energy planning, including energy-related climate change.

The DCMNR's Chief Technical Advisor provides technical advice on all energy matters relevant to the department, representation and external liaison. In addition, the Chief Technical Advisor has the following two specific executive functions:

- Serving as Ireland's Energy Installations Inspector, chairing the Minister's Technical Advisory Group, which is currently responsible for ensuring the safety of upstream natural gas developments.
- Co-ordinating energy R&D activities and being a member of the newly established Irish Energy Research Council.

The DoEHLG, has lead responsibility for the government's environmental policy, including the Kyoto Protocol. Following the government reorganisation in June 2002, DoEHLG is also responsible for nuclear safety issues. Roads policy was also previously part of DoEHLG but this has now moved to the new Department of Transport, which is also responsible for integrated transport policy.

The Department of Finance is responsible for energy taxation among other matters.

GOVERNMENT AGENCIES

The Commission for Energy Regulation (CER) was established under the 1999 Electricity Regulation Act to strengthen an open, transparent and accountable regulatory process for Ireland's electricity industry. The 2002 Gas (Interim) Regulation Act expanded the CER's jurisdiction to include both gas and electricity. Further information can be found in the following box.

The Competition Authority is an independent, statutory body, which was established in 1991. Its functions, as are set out in the 2002 Competition Act, include the enforcement of competition law, the review of mergers and competition advocacy. The 2002 Competition Act also clarifies the relationship between the Competition Authority and the sectoral regulatory authorities. It provides for a co-operation agreement between the Competition Authority and the sectoral regulator on the sharing of information and consultation to avoid duplication of efforts.

Sustainable Energy Ireland (SEI) was established under the 2002 Sustainable Energy Act. It is the government's principal agency for implementing energy efficiency and renewable energy policies. Its main functions are:

- To promote and assist environmentally and economically sustainable production, supply and use of energy.
- To promote and assist energy efficiency and renewable sources of energy.
- To promote and assist the reduction of greenhouse gas (GHG) emissions and transboundary air pollutants associated with the production, supply and use of energy.
- To promote and assist the minimisation of the impact on the environment of the production, supply and use of energy.
- To promote and assist RD&D of energy technologies.

The Environmental Protection Agency (EPA) is responsible for licensing all activities with a significant pollution potential, through the Integrated Pollution Control licensing system. The Agency is also responsible for implementing the Emissions Trading Directive in Ireland. It is overseen by the Department of the Environment.

MAJOR COMPANIES

The Electricity Supply Board (ESB) is the incumbent in the electricity market. It is owned by the State of Ireland, and ownership functions are carried out by the DCMNR.

EirGrid is the system operator of the Irish electricity transmission network. It is owned by the State of Ireland, and ownership functions are carried out by the DCMNR.

Bord Gáis Éireann (BGE) is the vertically integrated incumbent in the gas market. It is owned by the State of Ireland, and ownership functions are carried out by the DCMNR.

Bord na Móna is the state-owned peat-producing company. It is owned by the State of Ireland, and ownership functions are carried out by the DCMNR.

The Commission for Energy Regulation (CER)

Since the CER received expanded responsibilities in 2002, its role has continued to evolve and several pieces of secondary legislation transposing the EU Electricity and Gas Market Directives (2003/54/EC and 2003/55/EC, respectively) have transferred additional functions to the CER. Legislation in 2004 and 2005 expanded the CER's role in relation to the liberalisation of energy markets, legal unbundling of BGE, security of energy supply, and consumer protection. The range of functions carried out by the CER is evolving in line with the developing regulatory framework for energy sectors in Europe and in Ireland. It is expected that additional functions will be given to the CER during 2007 in respect to security of gas supply, through the transposition of the Natural Gas Security of Supply Directive 2004/67/EC, and in respect to the development of a SEM and in electricity and gas safety, through the enactment of the Electricity Regulation (Single Electricity Market) (Amendment) Act 2007 and the Energy (Miscellaneous Provisions) Act 2006.

The CER has a regulatory role in relation to the operation, maintenance and licensing of the transmission and distribution networks in the electricity and gas markets. The CER approves terms and conditions (including tariffs) for third-party access (TPA) to electricity and gas networks and facilities. The CER is also responsible for regulating prices charged to customers by ESB as public electricity supplier (PES) and by BGE. However, the Minister for Communications, Marine and Natural Resources remains responsible for the level of electricity market opening and the imposition of public service obligations. The CER responsibilities include the following:

- Ensuring sufficient capacity in the systems to satisfy reasonable demands for supply of natural gas and electricity.
- Protecting the interests of final customers, including the disadvantaged, the elderly and those residing in rural areas.
- Promoting competition in supply of electricity and natural gas, and electricity generation.
- Ensuring no unfair discrimination between applicants for or holders of licences, consents and authorisations, or between them and state-owned operators.

- Promoting the continuity, security and quality of supplies and encouraging safety and efficiency in undertakings and by end-users.
- Ensuring licence and authorisation holders are capable of financing their activities.
- Setting standards, enforcing compliance, settling disputes, controlling and monitoring performance and reporting regularly on these activities.
- Promoting research and the use of sustainable forms of energy that reduce or are free of GHG emissions, as well as adopting measures to protect the natural environment in all the sectors' activities.
- Advising government on the development and regulation of the gas and electricity sectors.

The CER is legally independent in the performance of its functions. It is funded by a levy on energy undertakings and income from licensing fees. In 2004, the CER was expanded from one to three members. It currently employs 62 staff (the CER received the necessary approval to recruit additional staff in 2006 to support its expanded role) and engages in a wide-ranging consultation process on all aspects of the future direction of the electricity industry. It is accountable for the performance of its functions to a Joint Committee of the Oireachtas (Irish Houses of Parliament) and is subject to audit by the Comptroller and Auditor General.

To avoid duplicating work, the Competition Authority has entered into an agreement with the CER. The stated purposes of the agreement are to facilitate co-operation between the Competition Authority and the CER in the performance of their respective functions insofar as they relate to issues of competition between undertakings; to avoid duplication of activity by the Competition Authority and the CER; and to ensure as far as practicable consistency between decisions made or other steps taken by the Competition Authority and the CER.

Table 2

Energy Taxes in Ireland, 2006

Fuel	*Excise rate (w.e.f. 4/12/2003) in Ireland (EUR per 1 000 litres)*
Unleaded petrol	442.68
Diesel	368.05
LPG	63.59

Source: *Energy Prices and Taxes*, Paris, IEA/OECD 2007

TAXATION

Energy in Ireland is taxed at a comparatively low level, compared to other European countries (see Table 2).

The National Climate Change Strategy (NCCS), published in November 2000, included a commitment to introduce an appropriate framework for greenhouse gas (GHG) taxation, focusing on CO_2 emissions, on a phased, incremental basis and in a manner that would take account of national objectives, particularly the maintenance of Ireland's international competitive position. In the 2002 Budget, the Finance Minister committed to having the issue of a carbon tax examined cross-departmentally, under the leadership of his department. The Department of Finance issued a consultation paper in July 2003 and the responses to the consultation paper were considered by an inter-departmental Green Tax Group to assist in the formulation of proposals for government. In the public consultation process, over half of those who expressed a view on the carbon tax were against it, including a number of significant representative bodies. Even many of those who had no difficulty with a carbon tax sought exemptions for various sectors and purposes. The government considered that any such tax, if imposed, would have to take into account some of these issues. The outcome of the process was a proposed carbon tax with the following features:

- An introductory rate of EUR 5 per tonne of CO_2 from April 2005, rising to EUR 7.50 in 2006 and EUR 10 in 2007. It was intended that the rate would match the price of carbon in the EU Emissions Trading Scheme (EU-ETS) over the long term.

- The proposed tax would not apply to entities involved in the EU-ETS.

- Priority to be given out of carbon tax revenue to the government's potential liability to purchase emission allowances in respect of the Kyoto Protocol commitment period (2008–2012).

- Part of the carbon tax revenue to be used to address fuel poverty through an increase in social welfare fuel allowances and additional funds for a capital investment programme targeted on improved energy efficiency in certain housing stock.

- A conditional 80% rebate of the tax payable by firms engaging in negotiated agreements with SEI to reduce emissions by verifiable actions;

the same level of rebate to apply to green-field high efficiency CHP installations.

- The use of the balance of any carbon tax revenue to be considered by the Finance Minister in the context of the annual budgetary process, bearing in mind the sectors affected.

In September 2004, the government concluded that a carbon tax was not an appropriate policy option, indicating that the environmental benefits would not justify the difficulties that would arise, particularly for households, from the introduction of such a tax. Another factor in the government's decision was the rapid oil price increases in July 2004. The government considered that the resultant increase in the real price of energy products would give an enhanced incentive to energy conservation. While a carbon tax would have involved a range of compensation, recycling and tax abatement measures, the government was concerned that, despite these measures, the tax would be likely to have some adverse economic and social effects that would not be fully dealt with by compensatory measures. In addition, it would impose price increases on many products already suffering sharp increases and would largely raise revenue from products already subject to existing excise duties and where a new tax was not specifically necessary to increase tax levels.

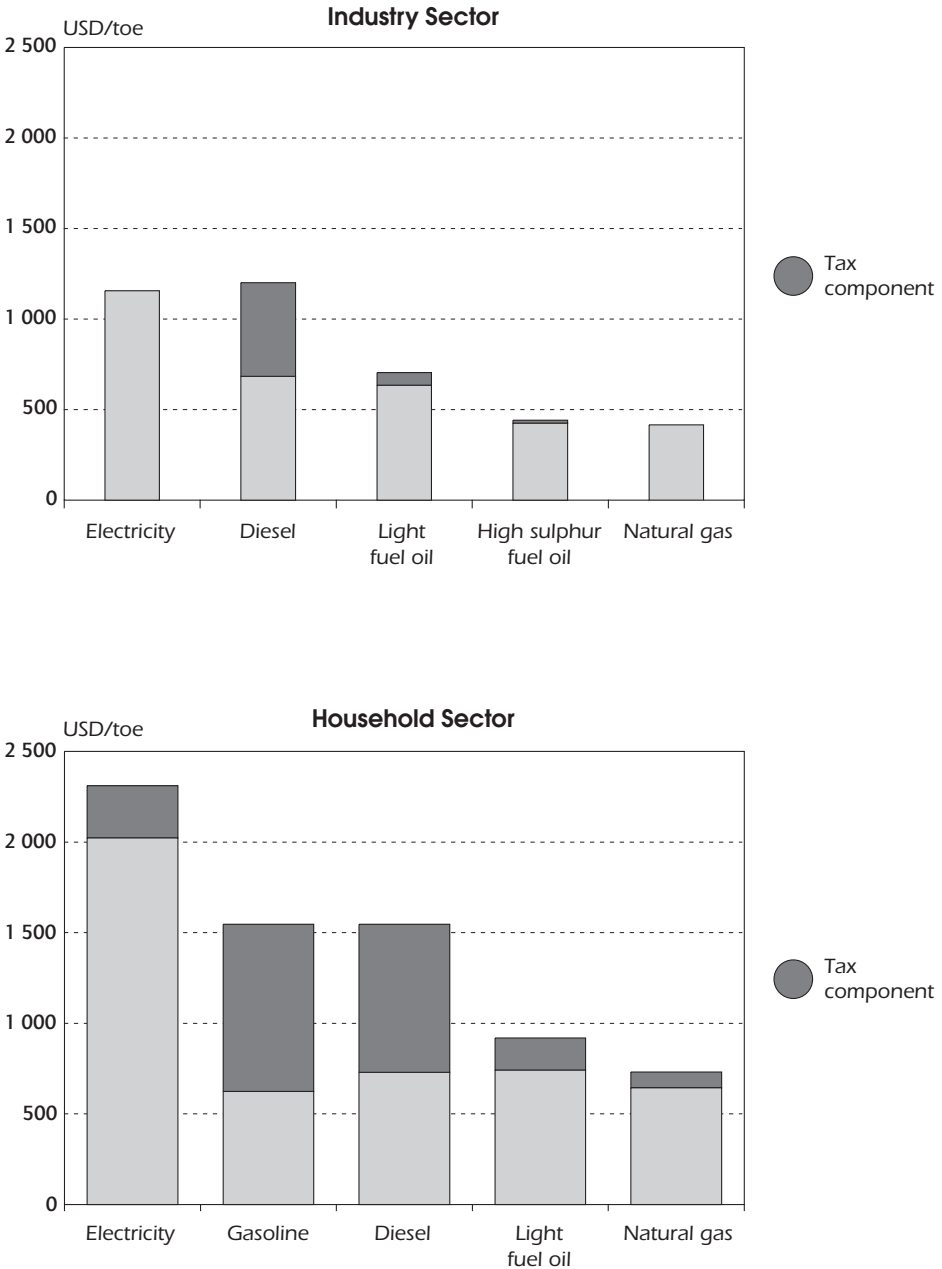
PRICES

Irish electricity prices are notably higher than the European average for both domestic and industrial consumers. Underlying the price increases is a very complex situation, with a combination of structural and market operation factors contributing to high price levels. High electricity prices are a symptom of the underlying structural conditions such as small market size, high demand growth, low reserve margin, low levels of interconnection with other countries, ongoing record investment in networks to cater for past underinvestment and recent high economic growth and a high dependence on imported fossil fuels. Fuel mix, and the specific reliance on gas for a significant proportion of generation needs, is the principal factor contributing to high generation costs. The impact of fuel mix in Irish electricity stations accounts for about 70% of the differential between generation costs in Ireland and Europe, where other member States have higher proportions of lower-cost hydro and nuclear generation. Higher-than-average labour costs and low levels of plant availability are also contributory factors.

Given that Ireland imports 87% of its gas supply from the UK, its gas prices are coupled to those in the UK market.

Figure 4

Fuel Prices, 2005



Sources: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

PUBLIC AWARENESS

COMMUNICATION

The DCMNR, the CER and SEI maintain a dialogue with the stakeholders throughout the energy sector. Consultation documents on specific issues are distributed and the comments received are published on the relevant websites, subject to meeting any requirements for preserving commercial confidentiality. Open meetings are organised to discuss policy initiatives or the outcome of consultation. SEI also regularly hosts speakers and conferences on various energy-related topics as part of its public-good mandate. Apart from the publication of consultation documents, the DCMNR maintains an up-to-date website with announcements of government and ministerial decisions and initiatives.

ENERGY FORECASTS

In addition to the sector-specific Generation Adequacy Report (produced by EirGrid) and the Gas Capacity Statement (produced by CER), the government uses the energy and environment projections published periodically by the Economic and Social Research Institute (ESRI), an independent research centre based in Dublin. A research team at ESRI, led by Professor John Fitzgerald, produces a medium-term review of the economy's prospects, covering the macroeconomy and industrial, labour market and demographic trends.

The most recent issue of the medium-term review was published in December 2005, covering the period 2005 to 2012. The review is published every second year, providing a comprehensive analysis of the prospects for the Irish economy over a seven-year time horizon. ESRI's approach is to develop a number of scenarios for developments in the global and Irish economy, for example a high-growth scenario, a low-growth scenario and a central case. ESRI draws a distinction between its shorter-term macroeconomic forecasts, produced separately at ESRI and published quarterly, and the medium-term review, which it sees as identifying possible alternative paths for the economy, rather than being a single firm forecast of the economy's future. The energy model of the review is a sub-sector of the main economic model, so that energy demand drivers, such as GDP growth, are derived from the macroeconomic scenarios. Energy demand equations for the principal demand categories are then estimated econometrically, with a separate model to capture trends in fuel use in the electricity generation sector. Projections of energy consumption by fuel are then used to derive projections for CO_2 emissions. When adding the assumptions on trends in non-CO_2 emissions, this gives projections on GHG emissions, up to and beyond the Kyoto commitment period.

SEI's Energy Policy Statistical Support Unit publishes a series of annual reports on energy trends entitled *Energy in Ireland*, the most recent of which covers the period 1990 to 2005 published in November 2006. In that issue EPSSU published forecasts of energy trends over the 15-year period from 2005 to 2020, produced by ESRI using the HERMES macroeconomic model linked to an energy model. The macroeconomic assumptions used were based on the high-growth scenario of the medium-term review 2005-2012, with projected prices for fuels and CO_2 allowances.

The development of comprehensive energy modelling and forecasting capacity is seen as a priority in the context of providing robust inputs to policy formulation. It is intended that the development of this capacity will be one of the tasks to be undertaken by the newly formed Irish Energy Research Council (see Chapter 8 on Energy R&D).

CRITIQUE

Ireland has enjoyed excellent economic growth during the last 15 years, with approximately 6% per year on average, and has attracted an impressive amount of foreign direct investment, albeit not in the energy sector. The economy is expected to continue to be buoyant, with low unemployment, and the government finances are healthy. High energy costs have become a serious concern for the government and the business community since 2004, and have prompted policy responses aiming to address domestic structural issues.

Ireland has a relatively small energy market, and low levels of interconnection with Northern Ireland and the United Kingdom. It also has limited indigenous fuel supplies, and severe environmental and policy constraints on the supply mix, such as nuclear energy being under statutory prohibition, while the electricity and gas markets are dominated by state-owned companies. The small size of the energy market coupled with the dominance of the incumbents has, up to now, made it more challenging to attract foreign investors. Although Irish energy policy has developed slowly since the last IEA in-depth review, the pace of new policy measures accelerated rapidly during 2006, leading to the publication by the government of the Green Paper, *Towards a Sustainable Energy Future for Ireland*, in October 2006. This comprehensive policy paper is one of the most visible achievements since the last in-depth review in 2003, and the first explicit statement on government energy policy in almost 30 years. The publication of the Green Paper is highly commendable. The Green Paper has taken into account various views from both domestic and international circles, including the recommendations made in the *Ireland 2003 Review* by the IEA. It will serve as the basis for the future energy policy, following public consultation and further refinement. The paper outlines options for the future direction of the Irish energy policy, which are in line with the IEA's three policy goals to achieve the following:

- Security of supply.
- Environmental sustainability.
- Economic development.

The Green Paper states the policy objectives, sets the targets, and to some extent suggests actions relating to each of these three goals. A solid analysis of Ireland's current situation is a constructive approach to establishing foundations for the proposed policy targets and actions. The government should consider finalising and then implementing the policies proposed in the Green Paper as soon as possible. At the same time, more analysis should be undertaken on the possible implications of global trends on the Irish energy policy, particularly in the context of enhancing its security of supply, to allow the development of a long-term strategy beyond the scope of Ireland and the EU.

However, the Green Paper lacks a real analysis of the implications of the global energy situation for the Irish energy policy in a long-term perspective. For example, the international gas market is now entering the new phase of becoming a more integrated regional market for LNG based on the Atlantic Basin, and the UK is one of the active new entrants into the world LNG market. A possible modification to the composition of the UK gas portfolio would have the potential to affect Irish energy policies and prices, given Ireland's reliance on gas imports from the UK. The government should consider undertaking the next step in the analysis of these implications as part of the White Paper process.

The Green Paper sets out the targets for the share of renewables in the generation mix and indicates the government's commendable commitment to electricity generation from renewable sources. While onshore wind power appears to be the most promising candidate owing to its economics and resource availability, the potential of other renewable resources, especially offshore wind, biomass and ocean energy, should also be fully explored. While facilitating the increase of renewables, the government should continue to keep cost-effectiveness in mind.

The Green Paper sets some specific targets, but a detailed road-map to achieve them would be useful for Ireland in order to enhance energy security in a sustainable way. For example, the target to improve energy efficiency by 20% by 2020 should be elaborated with further specific actions and sub-targets in each main consuming sector, together with the necessary financial support. Also, a further outline of detailed measures will be required to support the ongoing effort to increase the penetration of renewables such as wind. The lack of a specific action plan, a road-map on how the stated goals can be achieved, still represents a source of uncertainty for the market and investors. The investment climate can be improved substantially if the government can commit to a stable, clear and long-term action plan. More fundamentally, there is a risk that by assigning a range of targets in various areas, the possibilities for cost-effective reductions of CO_2 are in fact reduced.

Market reform in Ireland has been slow since the beginning of the transition phase in 1999. The government now expects that the development and implementation of the all-island electricity market (the SEM) and of a general energy framework will end this transition period, and move Ireland forward into a fully liberalised electricity market, where the power of the incumbent is curtailed. This undertaking is politically and economically vital, and could transform the landscape of Ireland's energy policy as a whole, increasing competition and security of supply.

The opening of the electricity and gas markets in Ireland began in 1999, broadly in line with the timetable required by the relevant European directives. The first EU electricity and gas directives were implemented through the following primary laws:

- 1999 Electricity Regulation Act: unbundling of the electricity TSO establishing EirGrid Plc. as a separate company.
- 2002 Gas (Interim Regulation) Act.

The Commission for Energy Regulation (CER) was established as the regulator for electricity in the 1999 act and its duties were extended to gas in the 2002 act. It has a high degree of power and autonomy, even though it is required to comply with general policy directions issued by the Minister for Communications, Marine and Natural Resources. The CER regulates the vertically-integrated incumbents, the Electricity Supply Board (ESB) in the electricity market and Bord Gáis Éireann (BGE) in the gas market. It is important to safeguard the independence of the regulator, to ensure that market participants develop and maintain confidence in regulation and transparency.

While the electricity market is fully open, the residential gas market will not be opened before July 2007. ESB in electricity and BGE in gas remain the largely dominant Irish suppliers, with about 70% of the market in electricity and 90% in gas, respectively. With the planned market reforms, an effort must be made to make incumbent companies more "normal" participants in their home market to avoid perverse incentives. This means that the key issue of ESB's and BGE's dominance needs to be addressed. Without this, new entrants will not feel comfortable in entering electricity and gas markets. The CER's intitiatives to reduce ESB's dominance and market share to 40% of the Irish market by 2010 through the divestment of price-setting plant are highly commendable.

Considerable regulatory effort is under way to integrate the gas and electricity markets of both Ireland and Northern Ireland. The SEM will be in place by November 2007. It is important that the SEM develops rapidly in order to stabilise the regulatory framework for investment in new generation and to provide a clear reference price at the all-island level. It is critical for Irish market reform that introduction of the reforms is not contingent on achievement of the SEM, but that it will take place in any case. The

establishment of a SEM will reduce the market share of ESB but may lead to a duopoly market situation. The potential risks associated with a dominant market position in the power sector are real, because of the highly sophisticated and complex power pool operations and market rules. In many cases of successfully liberalised markets, there is effective unbundling of generation, transmission and distribution businesses, and a limit on the market share of the incumbent utility.

However, the issue of the market scale is a material barrier to the development of competition in Ireland and will continue to have a major influence. The size of the market does not appear to be sufficient to attract foreign investors, and the government's policy of allowing other state-owned companies to develop into competitors to ESB is commendable.

Ireland has few indigenous resources in the form of gas, dispatchable renewable resources and peat, and remains largely dependent on fossil fuels. Since 1990, Ireland has become increasingly dependent on oil and natural gas, both imported. The country's total energy import dependence in 2005 was 90%, with imported oil and natural gas accounting for 79% of primary energy use. Furthermore, Ireland's energy infrastructure requires substantial investment to upgrade it. The government forecasts that the energy demand of Ireland will grow at a rate of 2% to 3% per year between now and 2020, and that Ireland will continue to be heavily dependent on fossil fuels, particularly imported natural gas and oil. In terms of security of supply and mitigation of greenhouse gas (GHG) emissions, the country's energy market situation will become more challenging to manage.

CER is an independent authority, which is responsible for security of electricity and gas supplies. As was the case four years ago, Ireland's energy security policies have been under certain constraints, owing to a tight electricity energy demand-supply balance, coupled with a lack of substantial domestic energy resources and the resulting high level of imports, and to the relative isolation and lack of extensive international energy connections.

Following years of underinvestment, the need to upgrade the Irish energy infrastructure is pressing. For this purpose, a consistent and clear policy framework for the future, short-term as well as medium- and long-term is required. The government should consider designating key infrastructure projects that will support Irish security of supply in the relevant legislation to enable accelerated delivery of these projects, thereby shortening the normal planning phase.

The recent progress achieved in the development of interconnections in the natural gas transmission network and the announcement of plans and a timetable for electricity interconnections, including a new one to be developed with Northern Ireland in the context of all-island energy market integration, are commendable.

Ireland's energy institutions are facing a challenging agenda to develop and deliver policies and measures. Further resources should therefore be made available, especially to the DCMNR, as well as to the other key government organisations and agencies.

Energy prices in Ireland have risen substantially. This is partially the result of structural inefficiencies, partially of ageing infrastructure, and to a significant degree of Ireland's exposure to the world and regional market prices for oil and gas. It is laudable that the government has not attempted to interfere with prices, and has instead begun to focus on addressing the structural and domestic causes of high prices. This course of action should be continued, with the government addressing the removal of barriers to competition, and facilitating the development of new infrastructure, while the regulator is left free to determine prices that adequately reflect the cost of supply. While this may be painful for some parts of the Irish economy in the short-term, it is a necessary adjustment process, which has the potential to lead to lower prices in the long-term.

RECOMMENDATIONS

The government of Ireland should:

- *Implement the policies outlined in the Green Paper,* Towards A Sustainable Energy Future for Ireland*, as soon as possible and develop a long-term road-map for the achievement of the goals, with special consideration for reducing energy import dependence.*
- *Assess and maintain the best balance among requirements for security of supply, environmental sustainability and economic competitiveness as outlined in the Green Paper.*
- *Continue to pursue the creation of the all-island energy market.*
- *Review the Irish energy policy direction regularly and monitor its implementation constantly, without waiting for the five-year interval, taking into consideration the fast pace of change in the global energy security situation.*
- *Consider increasing public awareness with adequate information outlining specific challenges, such as security of supply, sustainability, renewables and market reform.*

- *Continue its policy to increase transparency and competition by introducing further market-based mechanisms in the energy sector, addressing the needs of consumers and attracting new investment.*

- *Develop an integrated, long-term strategy to achieve an optimal mix of renewable resources in power generation. This strategy should take into account the costs of integrating renewables into the power grid and the impacts on electricity prices. It should also be based on a comprehensive assessment of the resource potential of renewables, including biomass and ocean energy.*

- *Continue efforts to improve the regulatory framework to ensure an efficient oversight of electricity markets while ensuring that the regulator has adequate resources to fulfill its mandate.*

In April 2007 the government published a revised *National Climate Change Strategy*, covering the period 2007-2012. The strategy sets out the measures that will enable Ireland to reduce its greenhouse gas emissions on a pathway consistent with meeting its Kyoto Protocol commitments. The strategy updates the analysis, contained in *Ireland's Pathway to Kyoto Compliance*, of the existing measures to reduce emissions, and sets out a range of additional measures that will have to be put in place. Total annual savings of approximately 13.6 million tonnes of CO_2 will be achieved by 2010. When the government's planned use of the Kyoto Protocol's flexible mechanisms is taken into account, savings of some 17.22 million tonnes will be achieved.

CLIMATE CHANGE

TRENDS IN GREENHOUSE GAS EMISSIONS

Ireland's greenhouse gas emissions (GHG) have risen considerably since 1990. This rise was primarily driven by a strong increase in CO_2 emissions, while the other dominant GHGs, namely methane (CH_4) and nitrous oxides (N_2O), remained relatively stable, or even decreased. The rapid change in the composition of the Irish economy is reflected in a shifting contribution of the various gases to total emissions. In 1990, CO_2 contributed 58.5%, CH_4 and N_2O together contributed 41.4%, and F-gases (HFC, PFC, SF_6)[3] contributed less than 1/1000th to all GHG emissions. By 2004, the CO_2 emissions contribution had reached 66.1%, CH_4 and N_2O had dropped to 32.9%, while F-gases contributed 1%.

Ireland's CO_2 emissions increased rapidly between 1990 and 2001, owing to strong economic growth. From 2001 to 2003, emissions declined thanks to one-off effects, especially a shift in industry from energy-intensive to light industries and a reduction in CO_2 emissions from the electricity sector. These emissions fell from 0.92 kg of CO_2 per kWh generated in 1990 to 0.62 kg in 2004, by 32%, owing to an increased use of natural gas, and the replacement of old peat-firing stations with new, more efficient ones. Emissions have now started to rise again, and are expected to continue to do so over the coming years, because of continuing strong economic growth.

3. HFC = hydrofluorocarbon; PFC = a group of five fluorocarbon gases; SF_6 = sulphurhexafluoride.

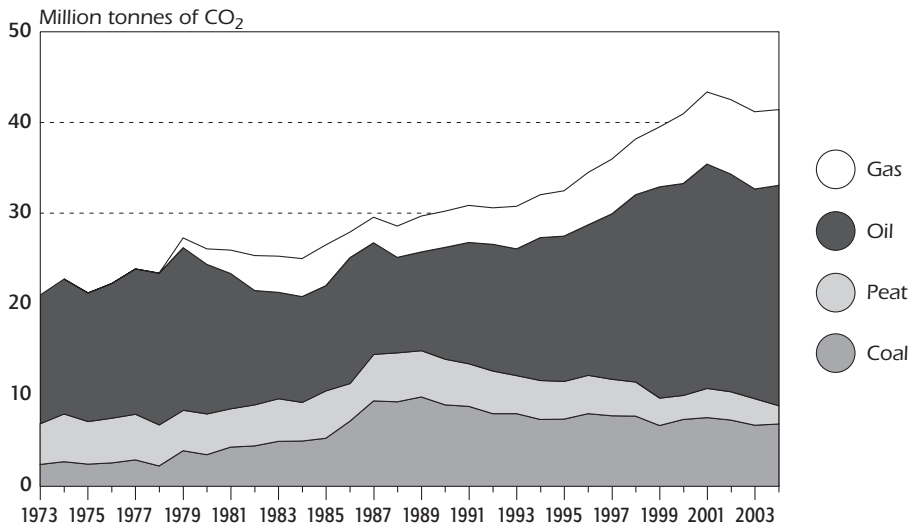
In 2004, CO_2 emissions stood at 45.3 Mt, a rise of 39% over 1990 when they stood at 32.6 Mt. The most dynamic period was from 1995 to 2001, when emissions increased by 34.2% from 34.8 Mt in 1995 to 46.7 Mt. This is equivalent to an annual increase of 5%, compared to an annual increase of 2.4% for the period 1990 to 2004.

Ireland's principal source of CO_2 emissions is energy use, and the main drivers for growth are oil consumption in the transport sector and increasing power generation, even though gas is replacing coal and peat (see Figure 5). Total emissions from fuel combustion in 2004 stood at 41.4 $MtCO_2$, a rise of 37% over the 1990 emissions of 26.1 $MtCO_2$. Table 3 shows the government's projection for CO_2 emissions during the Kyoto Protocol commitment period 2008 to 2012.

Three sectors contributed 71% to total CO_2 emissions in 2004, namely electricity production with 14.16 $MtCO_2$, road transport with 11.6 $MtCO_2$, and the residential use with 6.5 $MtCO_2$. In 1990, these three sectors contributed 82.4% to CO_2 emissions. In 2004, emissions from electricity production contributed 34.2%, and had increased by 34.5% from 1990 when they stood at 10.5 $MtCO_2$. Oil use in the transport sector accounted for 28%, or 11.6 Mt CO_2 in 2004, an increase of 150% over the 7.8 $MtCO_2$ the sector emitted in 1990, when it contributed 29.8% to emissions from fuel combustion. The residential sector saw a decrease over the period, thanks to the replacement of oil, coal and peat as fuel with natural gas. While it contributed 15.7% to CO_2 emissions in 2004, total emissions had decreased slightly by 1.7%, from 6.6 $MtCO_2$ in 1990.

Figure 5

CO_2 Emissions by Fuel*, 1973 to 2004

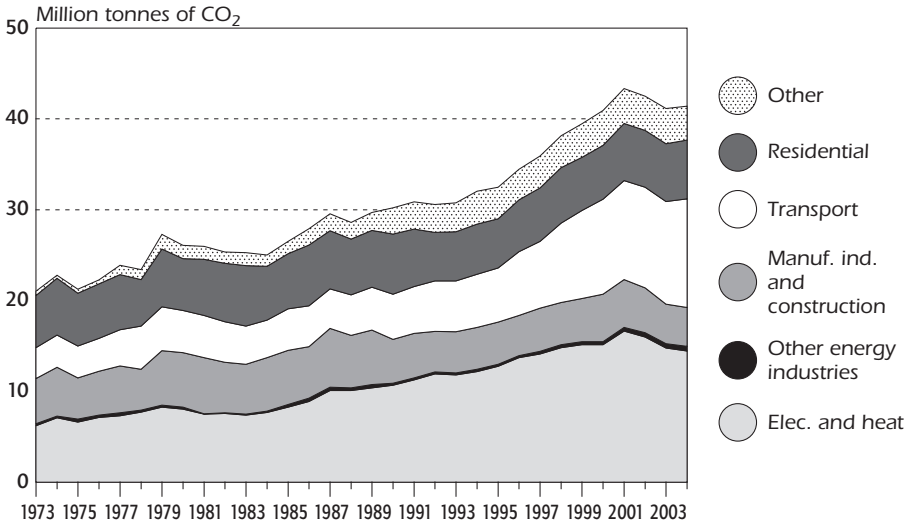


*estimated using the IPCC Sectoral Approach.

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2007.

Figure 6

CO_2 Emissions by Sector*, 1973 to 2004



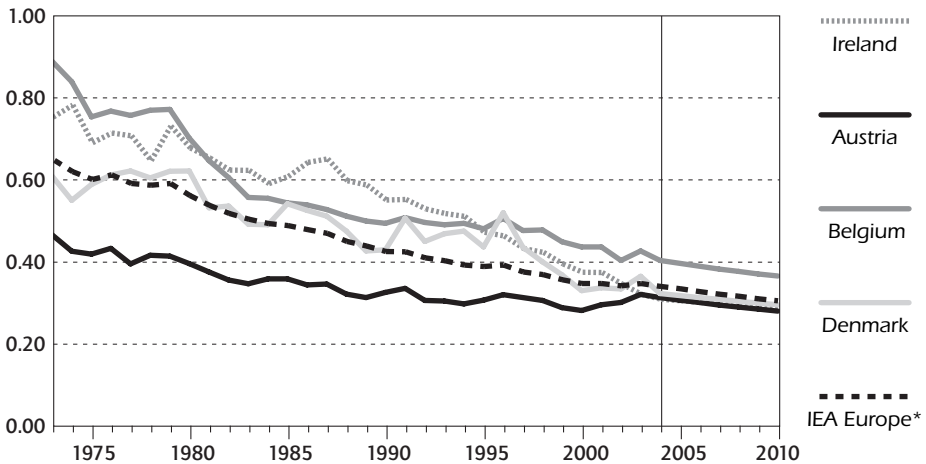
*estimated using the IPCC Sectoral Approach.

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2007.

Figure 7

Energy-related CO_2 Emissions per GDP in Ireland and in Other Selected IEA Countries, 1973 to 2010

(tonnes of CO_2 emissions per thousand USD GDP using 2000 prices and purchasing power parities)



* excluding Luxembourg and Norway throughout the series, as forecast data are not available for these countries.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and *National Accounts of OECD Countries*, OECD Paris, 2007 and country submissions.

Irish CO_2 emissions in relation to total GDP fell significantly between 1990 and 2004. From 0.55 tCO_2 per USD 1 000 of GDP at purchasing power parities (PPPs), they fell to 0.31 tCO_2 per USD 1 000 of GDP at PPPs by 2004, a total fall of 44%, or an annual rate of 4%. At the same time, CO_2 emissions per capita increased significantly between 1990 and 2004, from 8.62 tCO_2 to 10.2 tCO_2, by 18.3%, reflecting a significant increase in GDP per capita, the strong construction activity in a growing economy, and increased fuel consumption arising from increases in vehicle ownership as well as cross-border sales of transport fuels.

CH_4 emissions increased from 13.2 $MtCO_2$-equivalent in 1990 to 13.3 $MtCO_2$-eq. by 2004, an increase of 0.5%, while N_2O emissions decreased from 9.8 Mt CO_2-eq. in 1990 to 9.2 $MtCO_2$-eq. in 2004, a decrease of 5.7%. The main source for emissions of both of these gases is the agricultural sector. The emissions of F-gases increased significantly between 1990, when they stood at a combined 36.2 $ktCO_2$-eq., and 2004, when they had reached 665.6 $ktCO_2$-eq., a rise of 1 840%. This rise is primarily the result of an increase in the emissions from refrigeration and both fixed and mobile air-conditioning. Emissions of these gases from the electronics industry have fluctuated significantly in line with production in recent years, showing large increases between 1999 and 2004, followed by a substantial decrease in 2005.

Emissions from energy use were the largest contributor to all GHG emissions in 2004, with 44.4 $MtCO_2$-eq., or 64.9% of total GHG emissions, a significant increase compared to 31.7 $MtCO_2$-eq. in 1990, or 40.2%. The next important contributor is agriculture, with 19 $MtCO_2$-eq, or 27.8%. Industrial processes contributed 5% to total emissions, and waste 2.7%. Total emissions from agriculture and industrial processes had changed relatively little since 1990, although in industry, emissions had increased by 35.6% in 2001. In 2002 and 2003, two major industrial emitters closed, which involved the manufacture of steel and the production of ammonia and nitric acid for the fertiliser industry. These closures led to a reduction of industrial process emissions to the level of the 1990 emissions.

Efficiency improvements in the power and heat sector and closure of two big industrial emitters resulted in a decline in emissions from a peak of 27.1% above 1990 levels in 2001 to 23.1% above 1990 levels in 2004. Emissions in 2004 increased marginally (by 0.15%) over 2003 levels. In absolute terms, emissions in 2004 were 68.5 $MtCO_2$-eq., 5.5 $MtCO_2$-eq. in excess of Ireland's Kyoto Protocol target of 63 $MtCO_2$-eq. per year.

PROJECTIONS OF GREENHOUSE GAS EMISSIONS TO 2012

Updated projections of GHG emissions to 2012 across all economic sectors included in the National Climate Change Strategy (NCCS) were completed in March 2006 and published in the report entitled *Determining the Share of*

National Greenhouse Gas Emissions for Emissions Trading in Ireland 2008-2012. This report projected that, without any additional action, the 2001-2003 downward trend in annual emissions will be reversed over the second Kyoto Protocol commitment period (2008–2012) owing to continued economic growth and consequent increased demand for energy, construction materials and transport services.

Based on policies and measures already implemented or expected to be implemented up to 2012, projections show that Ireland will face an average annual shortfall in its Kyoto target of some 7.2 $MtCO_2$-eq. This updated "distance to target" takes into account all adopted and/or implemented policies and measures up to March 2006. Projections up to 2012 are based on the assumption that existing policies and measures will deliver the expected reductions in emissions over this period. The projected distance to target depends also on macroeconomic forecasts underpinning the projections, any deviation from which will have an effect on projected emissions.

Since the last IEA in-depth review, revised projections of GHG emissions have been published in 2004 and 2006. Both revisions were undertaken to make recommendations on the most economically efficient apportionment of Ireland's assigned amount units (AAUs) between those sectors of the economy participating in the EU-ETS and other schemes. The projections considered current measures and additional measures for the period 2008-2012 and provided revised estimates of Ireland's distance to target for Kyoto compliance. They also took account of common and co-ordinated EU policies affecting GHG emissions.

Table 3

Ireland's CO_2 Emissions Projection for 2012 by Trading/Non-Trading Sector in $ktCO_2$

	ETS	*Non-ETS*	*Total*
Projections with current measures (including sinks)	25 658	44 548	70 206
Share of emissions	37%	63%	100%
Additional measures assuming reduction cost of EUR 15/tonne	980	514	1 494
Projections with additional measures	24 678	44 034	68 712
Share of emissions with additional measures	36%	64%	100%
Share of reduction in $ktCO_2$	3 020	4 154	7 174
Share of reduction in %	42%	58%	100%
Kyoto target in $ktCO_2$	22 638	40 394	63 032
Share of reduction in %	36%	64%	100%

Source: Department of Environment, Heritage and Local Government.

Policy

Ireland is a party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. EU Council Decision 2002/358/EC set Ireland's target under the burden-sharing agreement to limit its emissions to no more than 13% above its 1990 levels.

Irish energy-related environmental policy objectives are based on, *inter alia*, government policy as set out in *Sustainable Development: A Strategy for Ireland* published in 1997 and reviewed in 2002, in the *National Climate Change Strategy* published in 2000, and in the Energy Policy Green Paper, *Towards a Sustainable Energy Future for Ireland*, published in October 2006. The Sustainable Development Strategy provides an overarching framework for the consideration of the environment in government policy-making and for the integration of environmental and socio-economic objectives. It also provides a context for sustainability of key economic sectors, including energy. The government will publish a new National Climate Change Strategy (NCCS), and a new National Sustainable Development Strategy in 2007.

Co-ordination of energy and environmental policies at the highest level is achieved through collective decision-making at cabinet level. Co-ordination and formulation of environmental and energy policy development are usually handled at ministerial level and through cabinet deliberations in a cabinet sub-committee structure, before a government decision is taken. Co-ordinated policy development at departmental level is undertaken through an inter-departmental committee structure. Specific committees exist for various aspects of energy and environmental policies for which co-ordination is considered necessary. Implementation of the NCCS is overseen and co-ordinated by an inter-departmental climate change team, chaired by the Department of the Environment, Heritage and Local Government. Other committees on which environment and energy policy co-ordination is required include the Renewable Energy Development Group, and the Ministerial Bioenergy Taskforce.

The government published the NCCS in 2000 as a basis for government policy and action in relation to climate change. The NCCS sets out a ten-year framework to ensure Ireland meets its target for the purposes of the Kyoto Protocol. The NCCS is based on a number of guiding principles including the following:

- The promotion of sustainable development.
- The maximisation of economic efficiency, including a preference for "no regret" and "least cost" measures.

- Achieving sectoral equity with relative costs and effort equalised across the economy.
- The protection of economic development and competitiveness, by utilising market-based instruments with the exploitation of new markets and opportunities.
- Generating an impetus for early action.

Ireland has transposed all the relevant EU directives into Irish law. Emissions trading in Ireland is based on the European Communities (Greenhouse Gas Emissions Trading) Regulations 2004 to 2005 (SI 437 of 2004 and SI 706 of 2005) which transpose Directive 2003/87/EC, as amended by Directive 2004/101/EC, into Irish law, establishing a scheme for a GHG emissions trading scheme.

The *National Inventory Report 2006*, published by the Environmental Protection Agency, incorporated significant revisions to the calculation of GHG emissions in a number of source categories established by the Intergovernmental Panel on Climate Change (IPCC). This has resulted in an upwards revision of Ireland's base-year emissions, against which progress is measured towards Ireland's Kyoto Protocol target. The amount notified to the European Commission at the end of 2006 was 315.2 $MtCO_2$-eq. for the Kyoto Protocol commitment period, or 63 $MtCO_2$-eq. per year from 2008 to 2012.[4]

The government has designated the Environmental Protection Agency as focal point and national authority for joint implementation (JI) and clean development mechanism (CDM) projects, respectively. The role of the agency will be to approve participation by private or public entities in JI or CDM project activities. The agency is expected to publish guidelines during 2007 setting out its approval procedures for participation by Irish entities in JI and CDM projects.

Measures

The NCCS sets out an integrated approach for emissions reductions, utilising the full range of policy options, including the following:

- The use of economic instruments, such as taxation and emissions trading with broad sectoral and/or cross-sectoral application.
- A broad range of policies and measures tailored specifically to relevant sectors.
- A vigorous and appropriate pursuit of common and co-ordinated policies and measures implemented at EU and wider international levels.
- Participation in international emissions trading.

4. The 2003 IEA review for Ireland recorded that Ireland's limit was 60.7 $MtCO_2$-eq. per year.

A major policy change occurred when the government decided in September 2004 that a carbon tax was not an appropriate policy option. It concluded that the environmental benefits of a carbon tax would not justify the economic and social difficulties that would arise, particularly for households, from the introduction of such a tax. Moreover, it was viewed that a carbon tax would apply to products that in many cases are already subject to excise duties and that, therefore, a new tax was not required to achieve the goal of implementing a "polluter-pays" approach for GHG emissions.

Ireland is a participant in the EU-ETS. The government plans that a significant contribution to the achievement of Ireland's Kyoto target will be made by sectors covered by the EU-ETS. These sectors account for some 33% of Ireland's total GHG emissions. In July 2006, Ireland notified the European Commission of its National Allocation Plan for the 2008-2012 period of the EU-ETS.

In Ireland, 109 installations are covered by the EU-ETS. Under the second National Allocation Plan (NAP II) covering emissions from 2008 to 2012, 22 638 $ktCO_2$ have been allocated, with an average annual new entrant reserve of 1 140 $ktCO_2$, including provisions for additional power plants. Ireland has imposed a limit on the use of Kyoto mechanisms, such as JI and CDM, of 50% on individual installations. Allowances from closing installations are put back in the new entrant reserve, and up to 0.5% of the total allocation will be sold to recover the cost of managing the EU-ETS. The NAP II allocation assumes that efficiency improvements with a cost below EUR 15 per tonne of CO_2 reduced are carried out by trading installations, while the remainder of the emission reduction effort assigned to the EU-ETS sector will be met by purchasing additional allowances. In November 2006, the European Commission requested that Ireland further reduce the allocation by 6.4% to 21 150 $ktCO_2$.

SEI had planned to introduce negotiated agreements in Ireland (see Chapter 4 on Energy Efficiency). A key incentive for these was the exemption from any future carbon tax. Following the 2004 government decision not to introduce a carbon tax, SEI had to refocus its work on the development of Energy Management Action Plans and, together with the National Standards Authority of Ireland, on a new Energy Management Standard.

Ireland will also use the flexible mechanisms available under the Kyoto Protocol to meet its target. The government has designated the National Treasury Management Agency (NTMA) as purchasing agent for the State. Legislation to establish this role for the NTMA on a statutory basis was published in December 2006. The purchasing activities of the NTMA will be underpinned by a carbon fund and EUR 270 million was allocated for this purpose by the government. The government has agreed to purchase a maximum of 18 million allowances to contribute to the fulfilment of Ireland's obligations under the Kyoto Protocol.

The NCCS identifies a range of sectoral and cross-sectoral measures to achieve the reductions in GHG emissions in an economic and environmentally efficient manner. Combined sectoral and cross-sectoral measures included in the NCCS were intended to reduce emissions by over 15 $MtCO_2$-eq. per year during the commitment period 2008 to 2012. Following a review of implementation of the NCCS, published in July 2006, measures already in place were calculated as reducing emissions by 8 Mt per year during the 2008-2012 period (see Table 7). Concrete measures by which the energy sector will contribute to reduced GHG emissions are the following:

- **Fuel switching:** a broad set of measures aimed at using less carbon-intensive fuels in the supply of energy throughout the economy, including in power generation.
- **Gas production and distribution:** the expansion and modernisation of the gas transmission and distribution networks is resulting in both a switch from more carbon-intensive fuels in domestic and industrial consumption and a reduction in fugitive emissions from the network.
- **Renewable energy:** Ireland is required under Directive 2001/77/EC to ensure that 13.2% of gross national electricity consumption comes from renewable sources by 2010.
- **Combined heat and power:** to build on the currently installed CHP capacity of 282 MW, the government is providing grant-aid to stimulate the further deployment of CHP in the industrial, commercial and services sectors.
- **Improving efficiency of electricity supply:** the efficiency of electricity supply is increasing thanks to the replacement of older generating plants with more efficient gas and peat plants and the increasing contribution of renewables to electricity generation. This trend is expected to continue as additional high-efficiency gas-fired power plants are commissioned in coming years.
- **Transmission and distribution losses:** energy losses from electricity transformation and distribution are being reduced owing to an ongoing network replacement programme.
- **Demand-side management:** Sustainable Energy Ireland (SEI) programmes to promote environmentally and economically sustainable production, supply and use of energy across all sectors of the economy, and energy efficiency programmes by the main electricity supplier, all contribute to reduced energy consumption. The energy regulator has also set targets for the principal electricity supplier to achieve energy efficiency gains in electricity end-use.

Although the NCCS originally identified the possibility to switch Moneypoint coal-fired power station to gas, thereby reducing GHG emissions significantly, the government has now decided that security of supply considerations rule this measure out.

In July 2006, the government published a comprehensive review of the NCCS. The review assesses progress achieved in each sector and in the implementation of measures proposed in the original NCCS. The review also outlines the policies and measures that will be implemented in the coming years and that will deliver benefits over the period 2008 to 2012. It also sets out areas that have potential to deliver further reductions in emissions and the measures that could be implemented to achieve those reductions.

Table 4

Contribution from Measures Identified in the NCCS, in $MtCO_2$-eq.

Measure	*Contribution*
CAP reform – full decoupling[1]	2.4
Afforestation	2.08
RES-E directive[2]	1.3
Landfill gas power generation / flaring	0.7
EU/carmakers' voluntary agreement	0.48
Building regulations Part L & EPBD[3]	0.3
Dublin traffic measures (e.g. port tunnel)	0.27
Biofuel excise relief	0.25
Implementation of landfill directive	0.06
Modernisation of natural gas network	0.06
Motor taxation / fuel labelling	0.05
Total	**7.95**

1. It is expected that reduced use of fertilisers and reduced livestock numbers will reduce GHG emissions.
2. Renewable energy supply – electricity.
3. Energy Performance of Buildings directive.

Source: Department of the Environment, Heritage and Local Government.

Evaluation and Monitoring

Implementation of the NCCS is overseen and co-ordinated by an inter-departmental Climate Change Team (CCT), chaired by the Department of the Environment, Heritage and Local Government (DoEHLG). This committee is tasked with monitoring the overall implementation of the NCCS and is assisted, where necessary, by relevant state agencies. Monitoring and

evaluation of individual policies and measures contained within the NCCS take place through evaluation of the impact of individual policies at a sectoral level by the relevant government department as well as through periodic revision of projections of GHG emissions. Evaluation of the emissions impact of relevant measures is undertaken in the context of regular revisions to GHG emissions projections.

Relevant government departments are responsible for the appraisal and evaluation of individual policies and measures which contribute to reduce GHG emissions. Proposals for new policies and measures must be tested for specific impacts, including impacts on the Exchequer, competitiveness and employment. In 2005, the government adopted guidelines on regulatory impact analysis. This tool must now be used to assess the likely effects of proposed new legislation or regulations. Proposed regulations not only must assess costs and benefits, but must also be tested for their environmental impacts, impacts on competition and consumers, contribution to compliance burden, and impacts on socially excluded or vulnerable groups.

The impact of climate change policies on other aspects of energy policy is assessed in the context of the fundamental objectives of energy policy to ensure security of energy supply, environmental sustainability and economic competitiveness. GHG emissions from the energy sector are influenced by the government's policy of ensuring fuel security in electricity generation through fuel diversity. This has led the government to decide, for example, to continue coal-fired electricity generation at Moneypoint and to commission three new peat-fired power plants supported by a Public Service Obligation (PSO) levy.

AIR POLLUTION

LEGISLATION, REGULATION, AND STANDARDS

Two new pieces of legislation concerning air pollution have been passed since the last review in 2003: the 2003 Protection of the Environment Act, which transposes certain provisions of Directive 96/61/EC concerning Integrated Pollution Prevention and Control; and the 2004 European Communities (National Emissions Ceilings) Regulations, which transposes the National Emissions Ceilings Directive 2001/81/EC for certain atmospheric pollutants. In the government's view, there are substantial synergies between measures to address the GHG impact of energy generation and consumption across the economy and the measures required to address transboundary emissions [SO_2, NO_x, particulate matter (PM), and volatile organic compounds (VOCs)], including in the areas of renewables, CHP and building standards.

In April 2005, the government approved a national programme for the progressive reduction of emissions of the four transboundary pollutants as required by Article 6 of Directive 2001/81/EC. This followed a public consultation process of a discussion paper issued by the DoEHLG on a strategy to reduce transboundary air pollution by 2010. The national programme sets out the main policies to address national transboundary emissions and it is currently being updated and revised and will be reported to the European Commission by mid-2007. Under the Clean Air for Europe Programme, Ireland is currently collaborating with the EC and other member States to develop the analytical basis to review the Directive, which will set targets for 2020.

The Environment Protection Agency Act 1992, the Ambient Air Quality Assessment and Management Regulations 1999, and the Air Quality Standards Regulations 2002 transposed the EU Air Quality Framework Directive 96/62/EC on ambient air quality assessment and management. The 2002 regulations also transposed Directive 1999/30/EC, which introduced limit values for NO_2, SO_2, lead and PM_{10} in ambient air, and Directive 2000/69/EC, which introduced limit values for benzene and CO. The Ozone in Ambient Air Regulations 2004 transposed Directive 2002/3/EC which introduced target values for ozone in ambient air.

Achieving the national emissions ceiling (NEC) targets for 2010, which in contrast to greenhouse targets are specified in absolute terms, will have implications for a broad range of sectors, including for the electricity sector. In 2004, power generation was responsible for 27% of NO_x, 34% of PM_{10}, 24% of $PM_{2.5}$, 62% of SO_2 and 0.3% of VOCs. The NEC and actual emissions are set out in Tables 5 and 6.

Table 5

Air Pollution in Ireland by Pollutant Target, 2001 to 2004 and 2010 in kt

Pollutant	*2001*	*2002*	*2003*	*2004*	*2010 Ceiling*	*Remaining Reduction Required*
SO_2	126	96	77	71	**42**	41%
NO_x	135	125	120	119	**65**	45%
VOCs	78	71	67	63	**55**	13%
NH_3[1]	117	115	114	114	**116**	0%

1. Almost entirely from the agricultural sector.

Source: Department of the Environment, Heritage and Local Government.

Table 6

Air Pollution in Ireland by Sector and Pollutant, 2001 and 2004 in kt

Sector	*2001*		*2004*		*Change 2004-2001*	
Pollutant	NO_x	SO_2	NO_x	SO_2	NO_x	SO_2
Road transport	50	2	44	1	–12%	–50%
Power generation	41	77	32	44	–22%	–43%
Industry	13	23	17	7	31%	–70%
Residential	5	13	6	11	20%	–15%
Commercial	3	9	3	5	0%	-44%
Total	**112**	**124**	**102**	**68**	**-9%**	**-45%**

Source: Department of the Environment, Heritage and Local Government.

POLICIES AND MEASURES

Emissions from all electricity generation plants are regulated under Integrated Pollution Prevention Control (IPPC) Directive 1996/61/EC to standards set out in the Large Combustion Plant Directive (2001/80/EC), which was transposed in Ireland as the Large Combustion Plant Regulations 2003. In addition, emissions from the older "existing" plants (those in operation before 1 July 1987) are regulated under a National Emission Reduction Plan (NERP) adopted for the purposes of the EU's Large Combustion Plant Directive. The NERP requires significant reductions of SOx and NOx emissions, more ambitious than those required by the directive, from older "existing" plants with effect from 2008. The agreement with ESB to close 1 300 MW of older power generating capacity (see Chapter 6 on Electricity) will significantly contribute to the reduction of emissions from the power sector.

New EU vehicle emissions standards for cars, trucks and vans were implemented in Ireland in 2005/06. Furthermore, Euro 5/6 standards, agreed in December 2006, should have a positive effect on air quality in Ireland when introduced from 2009. New fuel standards, which entered into force on 1 January 2005, included an element of sulphur-free fuels. Another measure that has improved the level of emissions from individual cars is the introduction in 2000 of National Car Testing, which includes testing of cars for the level of emissions produced.

Other initiatives to improve air quality in urban areas include the provision of additional bus corridors and buses, additional local railway and commuter rolling stock, further investment in the rail network, investment in major infrastructural projects such as the LUAS light rail network, the Dublin port

tunnel, the Dublin C-Ring road, the Jack Lynch tunnel in Cork and an increasing number of town bypasses. It is expected that all of these infrastructure measures will be implemented or extended over the course of the 2007-2013 National Development Plan.

In 2002, the DoEHLG and the Solid Fuel Trade Group signed a negotiated agreement to reduce the sulphur content of all bituminous coal and petcoke and also provided for the extension of the ban on the marketing, sale and distribution of solid fuels. The agreement was the result of a consultation process which commenced in 2001 with the public consultation paper *Potential National Ban on Bituminous Coal and Petcoke*. In April 2006, the DoEHLG and the Solid Fuel Trade Group signed a new negotiated agreement concerning further reductions in the sulphur emissions of bituminous coal and petcoke and the maintenance of existing limitations, through smokeless zones, on the marketing, sale and distribution of solid fuels. The new agreement, which runs until the end of the fuel season in April 2008, locks in place significant environmental gains achieved by the first agreement through ambitious limits on sulphur levels in bituminous coal and petcoke.

MONITORING AND REPORTING

Ambient air quality assessment is the responsibility of the Environmental Protection Agency (EPA), while air quality management is a matter for local authorities informed by the national air quality monitoring network.

The EPA's annual report *Air Quality in Ireland* contains details of the monitoring and assessment of national air quality, and incorporates data from all air quality monitoring stations operated by the EPA and local authorities. Air quality was good throughout the country in 2005 and complied with the air quality standards in force for all pollutants.

CRITIQUE

Ireland is facing a significant challenge with its Kyoto target of +13% compared to 1990 emissions, despite an upward revision of the 1990 baseline. In 2004, GHG emissions were 23% above the 1990 level, and they continue to increase. The Irish government plans to achieve its Kyoto target under the EU burden-sharing agreement by a mix of domestic measures and the purchase of approximately 3.6 $MtCO_2$-eq. of emission credits per year.

Emissions fell from 2000 to 2003, owing to a series of one-off measures, such as the closure of two major energy-consuming sites (steel works and a fertiliser plant), and improvements in the transformation sector such as the replacement of old peat-fired stations with modern ones, and the increasing

use of natural gas in the power sector. However, emissions are now returning to an upward path, and it is unlikely that this will change, given the increase of energy consumption linked to Ireland's economic growth.

Since the last review, two major policy changes have been made with regard to climate change. First, the commendable decision to retain Moneypoint as a coal-fired station, although it had been earmarked for replacement with gas-fired capacity as a major element in the government's climate change programme. This decision was in line with the recommendations of the 2003 in-depth review, which emphasised the contribution to security of supply from keeping fuel diversity. The second decision was not to proceed with the introduction of a carbon tax, given the negative social impact this would have at a time of rising energy prices, and the considerable difficulty to design a compensation scheme. Furthermore, the tax would to a large extent have fallen on goods already subject to excise taxes.

The first year under the EU Emissions Trading Scheme (EU-ETS) showed that Ireland had conducted a realistic allocation exercise. The government should be praised for this, and for continuing to apply a policy of restrictive allocation in the spirit of the scheme. Ireland has received feedback on the NAP II from the European Commission, and the further reduction required is comparatively small, again demonstrating a realistic allocation exercise. It is also commendable that allowances to older ESB generating stations scheduled for closure will revert to the new entrant allowance.

While a clear path has been laid out towards compliance with the burden-sharing agreement, elements of this path are in doubt. For example, almost 1 $MtCO_2$ emissions reduction is expected from transport-related measures. Half of this is to come from the EU vehicle manufacturers' voluntary agreement, and a quarter from infrastructure improvements in the Dublin area. It is not only highly unlikely that expected reductions from the vehicle manufacturers' agreement will be delivered, given the Irish vehicle-buying patterns, but it is more likely that the impact from vehicles on the achievement of the target will be negative.

Ireland is facing a major challenge in respect to its compliance with emissions of one pollutant under the Emissions Ceilings directive. The decision to continue to operate the Moneypoint coal-fired station is supported by a significant investment plan for flue gas desulphurisation (FGD) and selective catalytic reduction (SCR) to reduce emissions of the transboundary air pollutants SO_x and NO_x. The national ceiling for NO_x emissions for 2010, which is set in absolute terms, will remain a challenge, perhaps a disproportionate one, given the increased revised emission estimates from other sources in the economy, particularly transport, resulting from improved estimation methodologies and emissions data.

RECOMMENDATIONS

The government of Ireland should:

- *Continue to support the reduction of energy-related GHG emissions, and reinforce this by setting post-Kyoto targets.*
- *Review the contribution from the domestic measures, particularly in the light of developments in the transport sector, and adjust the climate change strategy to reflect recent developments.*
- *Consider the potential impact of energy efficiency and fuel-switching in the residential and building sectors for the achievement of climate change goals.*

OVERVIEW

Ireland is experiencing significant economic and population growth, leading to increased total energy consumption. Over the period 1990-2004, gross domestic product (GDP) grew by 140%, whereas total final consumption of energy (TFC) grew by 63%, indicating a significant increase in the country's energy efficiency.

Ireland's TFC in 2005 was 12.8 Mtoe, an increase of 63% above 1990 levels, at an average growth rate of 3% per year (see Table 7). The most significant growth occurred in the transport sector, followed by the "other sectors"[5] , while the industrial sector only experienced a slight growth of 10%. The rapid changes in fuel use and in importance between sectors are outlined in Tables 7 and 8, and give a clear indication of the structural change and rapid economic growth which the Irish economy underwent since 1990.

Ireland's energy demand has increased more rapidly in the transport sector than in the other sectors, leading to high oil dependence. This increase can be attributed to a number of factors linked to population growth, the growth of the Irish economy, rising employment, an augmentation in demand for housing leading to urban sprawl, increased commuting, higher passenger throughput at airports and more domestic and international freight movements. Furthermore, Irish citizens are buying more and larger cars as disposable income increases, and this is offsetting fuel efficiency improvements in vehicles.[6]

The intensity of energy use in Ireland, measured as TPES per GDP, has fallen by 41% from 0.22 tonnes of oil equivalent (toe) per EUR 1 000 of GDP (in constant 2000 values) in 1990 to 0.13 toe per EUR 1 000 in 2004, at an annual rate of 3.6% (see Figure 8). Energy intensity measured by TFC fell by 32% during the same period, at an average rate of 3.3% per year. In 1990, 0.16 toe were consumed to produce EUR 1 000 of GDP (in constant 2000 values) whereas in 2004 only 0.1 toe was required for the same amount of GDP. The decrease in primary energy intensity has recently been balanced by an increase in final energy intensity. Between 2004 and 2005, primary energy intensity fell by 1.1%, while final intensity increased by 0.9%, almost

5. Residential, commercial, agriculture, public services, military.
6. The government has been asked to provide more detailed numbers regarding the development in transport demand.

cancelling the improvement in efficiency in the transformation sector. Throughout the 1990s there has been a slight convergence of the trends in primary and final energy intensity. This mostly reflects the increasing efficiency of the electricity generation sector. New plants being commissioned, such as combined-cycle gas turbine generators (CCGT), tend to be of higher efficiency and have contributed to increasing the aggregate efficiency of the transformation process. Increasing production from CHP and renewable sources of energy also contributed to this development.

Table 7

Growth Rates and Shares of Fuels in TFC, 1990 to 2005

Fuel	*Contribution Mtoe 1990*	*Contribution Mtoe 2005*	*Growth % 1990/2005*	*Share % 1990*	*Share % 2005*	*Change of share %*
Coal	1.2	0.5	–58	14.8	3.9	–73.4
Peat	0.6	0.2	–67	7.4	1.6	–78.7
Oil	4.2	8.5	102	51.9	66.9	29.1
Gas	1.0	1.3	30	12.3	10.2	–17.1
Combustible Renewables & Waste	0.1	0.2	100	1.2	1.6	27.6
Electricity	1.0	2.0	100	12.3	15.7	27.6
Total	8.1	12.7	57	100.0	100.0	

Source: IEA.

Table 8

Growth Rates and Shares of TFC by Sector, 1990 to 2005

	Fuel use Mtoe		*Growth rate %*	*Share %*		*Change of share %*
Sector	*1990*	*2005*	*1990/2005*	*1990*	*2005*	*1990/2005*
Industry	2.4	2.6	10	31	21	–32
Transport	2.0	5.1	150	26	40	54
Other	3.4	5.0	48	44	40	–9
Total	7.8	12.7	63	100	100	

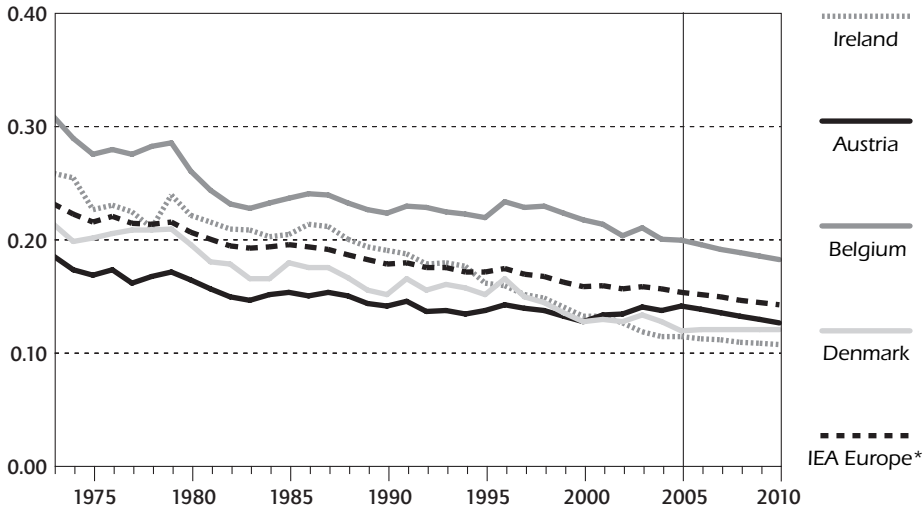
Source: IEA.

Intensity of electricity use in the economy has fallen by 32% from 295 kilowatt-hour (kWh) per EUR 1 000 of GDP in 1990 to 200 kWh per EUR 1 000 of GDP in 2005. This fall was not as fast as the fall in overall primary energy intensity, but equal to the fall in final energy intensity. Of particular concern is the rapidly increasing use of electricity in the tertiary sector where electricity use increased by 125% compared to 106% in the economy as a whole.

Figure 8

Energy Intensity in Ireland and in Other Selected IEA Countries Measured by TPES, 1973 to 2010

(toe per thousand USD at 2000 prices and purchasing power parities)



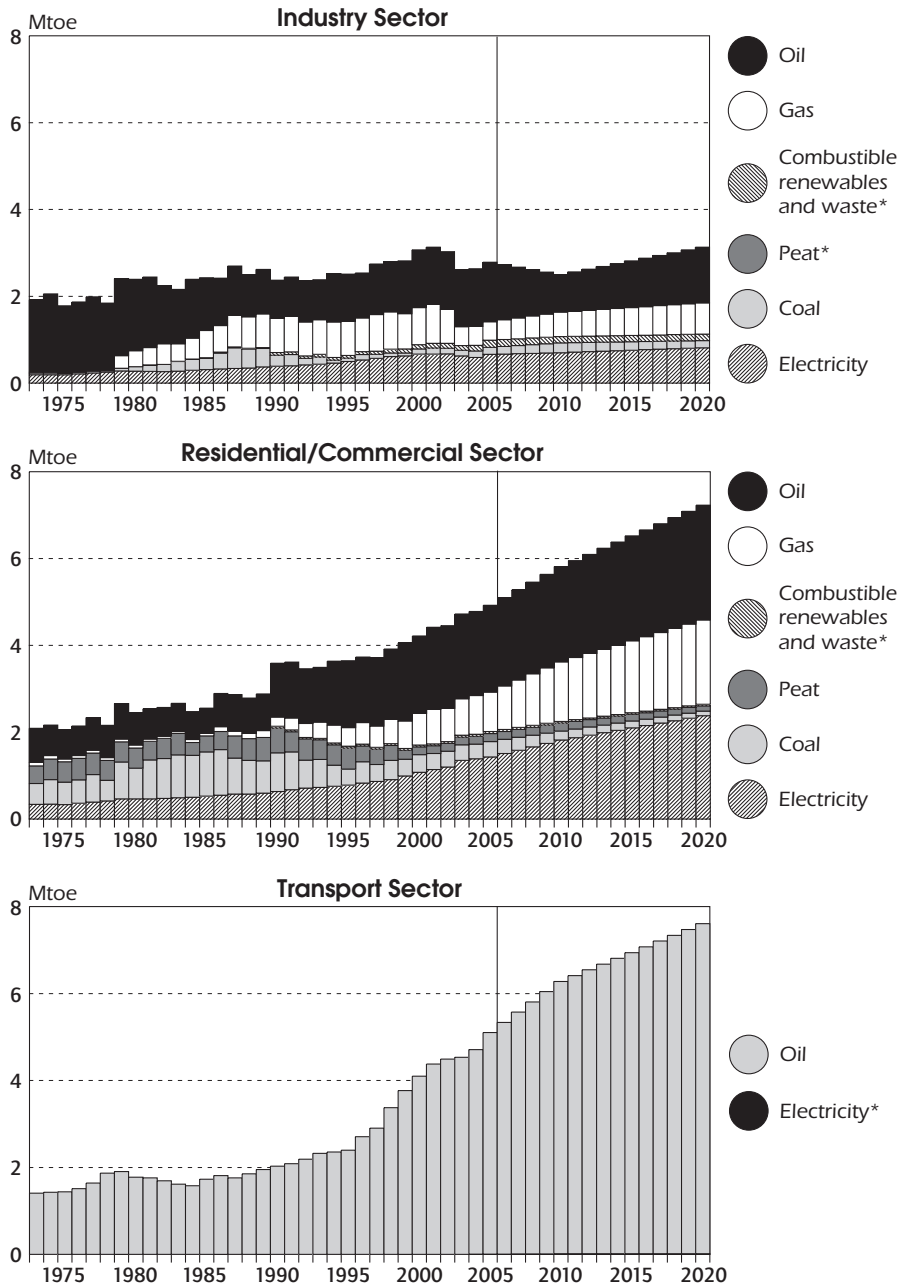
* excluding Luxembourg and Norway throughout the series, as forecast data are not available for these countries.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and *National Accounts of OECD Countries, OECD Paris*, 2007 and country submissions.

Transport energy intensity in Ireland, measured by toe consumed per EUR 1 000 of GDP in constant 2000 values, has declined even less than electricity intensity, by only 3.2% between 1990 and 2005, leading to very high oil dependence. The rate of fall was only one-tenth of the rate of fall in final energy intensity.

Figure 9

Total Final Consumption by Sector and by Source, 1973 to 2020



* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006 and country submission.

Sustainable Energy Ireland (SEI)

Sustainable Energy Ireland is the statutory national energy agency, and is responsible for several programmes designed to improve and enhance energy efficiency measures in Ireland. SEI is also the channel for the delivery of the energy efficiency elements of the National Development Plan (NDP) 2000-2006 for which it designed a suite of programmes. In implementing the energy aspects of the NDP, SEI is involved in promoting energy efficiency in the built environment, residences, business and public sector buildings. It also has a series of R&D programmes aimed at encouraging the development of renewable and alternative energy technologies, which, when installed, can improve energy efficiency and assist Ireland in meeting its Kyoto obligations. SEI's programmes targeting energy efficiency include the following:

- Industry Energy Agreements Programme.
- Large Industry Energy Network (LIEN).
- House of Tomorrow Programme (HoT).
- Public Sector Programme.
- Low Income Housing (incorporating the Warmer Homes Scheme).
- Technology Promotion Programme.
- Energy Management Action Programme (EMAP).
- Consumer Awareness Programme.
- CHP Programme.

SEI also has a lead role in developing and maintaining comprehensive national and sectoral statistics for energy production, transformation and end-use. These data are vital for international reporting obligations, advising policy makers and informing investment decisions. The Energy Policy Statistical Support Unit (EPSSU) is SEI's specialist statistics team. Its core functions are as follows:

- Collect, process and publish energy statistics to support policy analysis and development in line with national needs and international obligations.
- Conduct statistical and economic analyses of energy services sectors and sustainable energy options.
- Contribute to the development and promulgation of appropriate sustainability indicators. Reports published by EPSSU, such as *Energy in Ireland 1990–2005*, SEI's annual review of energy trends, and documents on issues and indicators, are available on the SEI website.

SEI also significantly contributes to policy development in Ireland by, for instance, participating in the development of the Ocean Energy Strategy (see Chapter 8 on Energy R&D).

POLICIES AND MEASURES

POLICY

Ireland's energy efficiency policy is based in particular on the EU Green Paper on Energy Efficiency and general Irish policy on sustainable energy, with the latter establishing a framework for energy efficiency and setting out policies and measures to promote energy efficiency considered appropriate for Irish circumstances. The main vehicles for the implementation of policy are the National Development Plans, which access funding from EU budgets to support the structural development of Ireland.

The National Development Plan (NDP) 2000-2006 contained a sustainable energy priority comprised of two energy measures, one of which included energy efficiency. A total investment of EUR 117 million is earmarked for energy efficiency and alternative energy programmes under this NDP. SEI is the primary implementing body for energy efficiency policy in Ireland, operating a range of programmes addressing all sectors of the economy as described below.

NEGOTIATED AGREEMENTS AND ENERGY MANAGEMENT STANDARDS

SEI-run programmes, which specifically target the industrial sector, include the Large Industry Energy Network (LIEN) and the Industry Energy Agreements Programme. The LIEN is a voluntary networking initiative comprising 80 of the largest industrial energy users in Ireland that are committed to reducing their energy use on an individual basis and recognise the benefit of collaborating with like-minded organisations. These companies have a combined spending on energy of approximately EUR 300 million. The main elements of the LIEN programme are reports on energy performance progress and the setting of realistic targets, sharing information and experience to achieve best practice and improving competitiveness by reducing energy costs. In 2004, SEI estimated that the LIEN saved 134 $ktCO_2$, equivalent to 3.5% of emissions from participating companies, and 484 gigawatt-hour (GWh) or 3% of energy consumption of participating companies through energy efficiency measures. In 2002 and 2003, SEI engaged in a pilot negotiated agreements programme involving 26 companies. The programme estimated energy efficiency gains in a business-as-usual scenario of 5.4% for individual agreements, 16.4% for collective agreements and 17.1% for technology agreements.

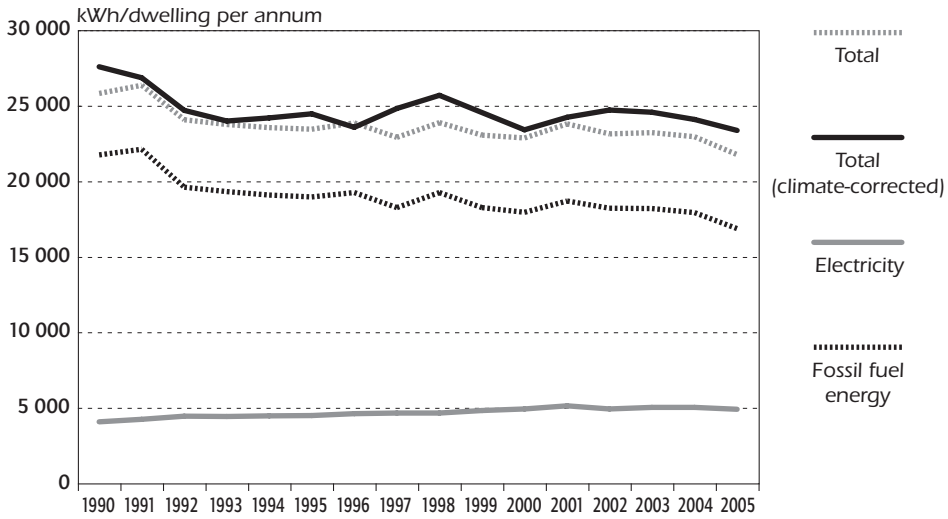
The recently launched Energy Agreements Programme is based on the Irish Standard on Energy Management Systems (IS 393). By joining the Energy Agreements Programme, companies agree to work towards achieving certification to IS 393, and they are supported in this by targeted advice from

SEI. IS 393 requires that company energy use is managed through a formal structure with the aim of achieving significant savings in energy use and GHG emissions. It covers all aspects of a company's approach to managing its energy costs and use, and it is designed for large, energy-intensive enterprises, which may be more exposed than others to changes in energy costs. SEI's target was to have 20 of Ireland's largest industrial energy users signed up to the programme by the end of 2006, and to eventually work with 60 to 100 of the largest industrial energy users in Ireland.

The Energy Management Action Programme (Energy MAP) is in place for those companies that may not have the resources to commit the audit requirements necessary to obtain IS 393. IS 393 is working as a complement to participation in the EU-ETS. The core of the programme is the Energy MAP website, which provides best-practice guidance in energy management and the latest technologies. Energy MAP is open to businesses across various sectors of the economy, including the industrial, commercial and retail, education and health sectors. Unlike Energy Agreements, Energy MAP is designed to assist less sophisticated and committed firms in adopting sustainable energy management programmes within their organisations. The principal users of Energy MAP will comprise small and medium-sized enterprises (SMEs), but the website is a reference portal for energy efficiency guidance for both large users and SMEs. While the Energy MAP website tool and support programme are less formal than the 2005 IS 393, they are based upon the same principles.

Figure 10

Unit Consumption of Energy per Dwelling (permanently occupied)



Sources: Based on SEI, CSO and Met Éireann data.

BUILDINGS AND RESIDENTIAL SECTOR

In addition to the programmes aimed at specific sectors, SEI also runs a number of programmes which target the built environment in general. Buildings are a major energy consumer, accounting for about 40% of Irish energy consumption. It is expected that energy demand in buildings will grow each year, unless some action is taken to ensure that new and existing buildings adopt higher levels of energy performance.

The House of Tomorrow (HoT) Programme aims to accelerate improved energy performance in both existing and new building stock. It funds projects on researching, developing and demonstrating more sustainable energy practices. Its focus is to stimulate the widespread uptake of superior sustainable energy planning, design, specification and construction practices in both the new home building and home improvement markets.

In Ireland, the Energy Performance in Buildings Directive (EPBD) is expected to affect over 150 000 sale or rental transactions per year in the residential market. In April 2005, SEI published a draft action plan for the implementation of the EBPD. A revised action plan was published in July 2006, while those aspects of the EPBD affecting air-conditioning units have been transposed into Irish law in 2006. Final transposition of the EPBD in relation to Building Energy Rating (BER) was achieved in December 2006.

PUBLIC SECTOR

The Public Sector Programme aims to stimulate the application of improved energy efficiency design strategies, technologies and services in public-sector construction and retrofit projects, acting both as an exemplar for good practice and as a demand leader for the services and technologies involved. The programme had a budget of EUR 12.7 million funded through the National Development Plan (NDP) over the period 2001 to 2006. The market response to the programme has been positive, with the first two action lines fully subscribed at present. As a result, both parts of the programme, the Design Study Support Scheme and the Model Solutions Investment Support Scheme, are currently closed for individual applications.

TRANSPORT

The NDP provided for investment of EUR 3 billion over the period 2000 to 2006 in public transport. This included upgrading the national public transport network and, in particular, increasing the capacity of urban public transport. There has also been significant investment in improved traffic management, particularly bus priority measures.

The new NDP will be significantly augmented by the Transport 21 Programme, which provides for total capital funding of EUR 34 billion from 2007 to 2016, including EUR 16 billion in public transport. This major rebalancing of investment in favour of public transport aims to provide more choice and an alternative to the private car, particularly in major urban areas, and is expected to encourage a modal shift from the private car to less polluting and less energy-intensive public transport. Over the period of investment in Transport 21, the government expects that Ireland's transport system will be transformed into an integrated network. Public transport capacity will almost double in the Greater Dublin area including seven new LUAS (light rail) projects, DART (suburban rail) extensions, two metro lines, a significant expansion of the bus network, improved cycling and pedestrian facilities and traffic management support measures. A high-quality strategic road network will be delivered in Ireland with the completion of the inter-urban routes by 2010. Regional public transport will be improved with substantial bus and rail investment and support for the cycling network and pedestrian facilities in cities will continue. More frequent intercity rail services will be provided, and the Western Rail corridor will be reopened.

Additional transport infrastructure and services are not expected to be able to meet all of the growth in travel demand, and a detailed sustainable transport action plan will be developed, including the following:

- Land-use policies that bring homes, work places and services closer together or facilitate better links with public transport, cycling or walking.
- Soft measures to reduce car use, including car-sharing, flexible working and individual or work-place travel plans.
- Fiscal measures to encourage sustainable travel behaviour and to discourage unsustainable travel once the relevant infrastructural investment has taken place. Measures could include some form of congestion charge in Dublin city centre and possibly a wider Metropolitan Area destination charge, towards the end of the ten-year Transport 21 period, once a major enhancement of public transport capacity has been delivered.

As an integral part of Transport 21, the government is planning a public awareness campaign that will focus on the benefits of eco-driving and its potential to reduce fuel consumption. Transport 21 also provides funding for a range of sustainable transport initiatives, which include pilot projects to test the feasibility of eco-driving as a means of increasing fuel efficiency and decreasing CO_2 emissions in the public transport, road haulage and taxi sectors. The results of these pilot projects will be assessed as input to policy development in this area.

A 50% reduction in vehicle registration tax (VRT) was applied to hybrid-electric cars until the end of 2006 to stimulate the market for these vehicles. The number of hybrid-electric vehicles increased from eight in 2002 to

248 in 2004. This VRT relief was extended to flexible-fuelled vehicles for a trial period of two years, following its announcement in the 2006 Budget. The government is currently assessing the feasibility of rebalancing VRT even further and also to change motor tax in line with CO_2 emissions as a means of addressing emissions from the transport sector.

OTHER DEMAND-SIDE MEASURES

SEI's Consumer Awareness Programme aims to motivate consumers to become more energy-efficient in their daily lives by making them aware of their energy usage and informing them of simple steps they can take to become more energy-efficient. As part of Energy Awareness Week (EAW) 2005, SEI launched a website to increase consumer awareness of climate change and energy issues. The realisation of the need for a year-round intensive approach has led to the introduction of the government's Power of One campaign.

The multi-annual energy efficiency media campaign Power of One, which was launched in September 2006, is aimed at changing people's behaviour towards more efficient use of energy. Its aims are to encourage monetary savings; avoid and prevent energy waste; reduce the amount of energy used; and use more energy-efficient plants, equipment, appliances and vehicles. The campaign is designed to instil a sense of individual and collective responsibility for energy use and the environment and thereby encourage changes in behaviour and lifestyles. It will highlight simple steps that people could take in their everyday lives to make energy savings, which would lead to an improved environment for their own and future generations.

A Technology Promotion Programme is also used to conduct awareness-raising activities through, for instance, SEI's Sustainable Energy Awards, training courses and the publication of good practice guides. The aim of the Technology Promotion Programme is to inform organisations about best-practice energy efficiency solutions and strategies.

There are a number of demand-side management (DSM) measures currently in place in the Irish electricity market, described in Table 9. The schemes aim to flatten the load curve, thereby reducing the need for less efficient mid-merit and peaking plants. In total, they reduce demand by 160 to 210 MW, equivalent to up to 4.5% of absolute peak demand in Ireland.

Short-term Active Response (STAR) is an EirGrid scheme aimed at enhancing the reliability of the system. Electricity consumers contract with EirGrid to make their load available for short-term interruptions that are automatically initiated following a frequency dip. The programme contributes towards the transmission system operator's (TSO) Operating Reserve requirements and as such is regarded as an ancillary service. The TSO has contracted 38 customers to provide this service, following a competitive procurement process in 2003.

Approximately 50 MW of automatic load response has been contracted under the STAR scheme, approximately 28 MW of which is currently commissioned. The types of loads participating in the scheme include cement works, cold storage facilities, mines, quarries and general manufacturing facilities.

Table 9

Summary of Demand-Side Measures in Ireland

Demand management schemes	Short-term Active Response (STAR)
	Powersave
	Winter Peak Demand Reduction Scheme (WPDRS)
	Tariffs providing time-of-day incentives: • Winter Demand Reduction Incentive (WDRI) • Nightsaver Tariff
Other measures	Peak demand reduction campaigns
	Energy efficiency campaigns

Sources: EirGrid, ESB, CER.

Powersave is a voluntary scheme which provides a financial incentive to customers to reduce electricity demand on request. It is currently operated by ESB Power Generation. All licensed electricity suppliers can offer Powersave to their customers. Powersave's objective is to provide emergency load relief during periods of generation shortfall and to prevent load shedding of customers. It represents an economic purchase, which can be called upon at any time of year, providing up to 50 MW of demand reduction at short notice; 122 customers are currently signed up to the scheme. Powersave Day reductions typically reduce demand load by 30 to 50 MW.

The Winter Peak Demand Reduction Scheme, introduced in the winter of 2003/04, offers financial incentives to business customers to reduce electricity consumption during the power system's peak hours between 17h00 and 19h00 during winter months (November to March). The scheme is administered by the TSO via suppliers. It is an important element of ensuring security of supply in Ireland during winter, providing up to 100 MW of demand reduction during peak hours. 246 customers participated in the 2005/06 scheme. The estimated average daily demand reduction delivered by the scheme in November 2005 was 90 MW. In the winter 2004/05, EUR 4 million was paid by the TSO to participating consumers.

Winter Demand Reduction Incentive (WDRI) is an ESB Customer Supply tariff. Customer demand is normally measured between 08h00 and 21h00, Monday to Friday on the maximum demand (MD) tariff, whereas with the WDRI, demand is only measured for two hours each day, 17h00 to 19h00 from

November to February. This provides an incentive for customers participating in this scheme to displace demand outside peak hours. Reduction obtained by this scheme is now, at most, 20 to 30 MW.

The public electricity supplier provides a domestic Nightsaver Tariff to customers with a Nightsaver meter, which has two dials – one recording day units (kWh) used and the other recording night units (kWh) used. Customers pay a higher standing charge than the standard domestic tariff every two months on their electricity bill. In return they get cheaper electricity (less than half the daytime rate) between 23h00 and 08h00 (winter time) and between midnight and 09h00 (summer time).

CRITIQUE

The structure of Ireland's economy has changed considerably over the past 20 years, shifting in the direction of high value-added, low energy-using sectors such as pharmaceuticals, electronics and services. Energy intensity in Ireland will continue to show a decreasing trend if, as expected, the economy continues to move away from low value-added, high energy-consuming sectors to one that is dominated by high value-added, low energy-consuming sectors. While this will result in a efficient economy from an energy perspective, it does not necessarily mean that the actual processes used are more energy-efficient. As a consequence of this structural shift, Ireland's energy intensity has dramatically improved since 1990 to reach one of the lowest levels of all IEA countries.

As outlined in the Green Paper, the challenge for the government is to maintain, build on and expand this efficiency gain. To achieve this, it is crucial to identify the various reasons explaining this progress and to understand to what extent this improvement has been achieved by energy efficiency policy efforts as opposed to structural changes in the Irish economy. Structural changes have occurred, such as the closure of energy-intensive industries, like steel, which existed 15 years ago and have now been replaced by high value-added low energy-intensive companies, such as services, electronics and pharmaceuticals, the replacement of ageing power stations by modern ones, and the increasing use of gas in power generation also led to improvements in the transformation sector.

It is also important to understand where and why energy efficiency gains were registered among the different uses of primary energy, such as in energy production and transformation, in industry and agriculture, in the residential/commercial and transport sectors, and what will be the most promising sectors for additional energy efficiency gains in the future, in order to enable the government to focus its efforts on these. The analysis of the past and the understanding of future trends show where the most important energy efficiency gains will be in the future.

The target for energy efficiency in the Green Paper is to improve global energy efficiency by 20% by 2020. The government should consider carbon intensity in achieving this target, taking account of the need to ensure fuel diversity in Ireland. It would also be useful to develop this general target with indicative energy efficiency sub-targets for each of the main energy-consuming sectors of the economy in order to identify the most important focus areas. This should start with an assessment of the savings potential in each sector, and it could be linked to the requirement to decrease the dependence on imported energy. These indicative sub-targets would give clearer signals to help mobilise energy users, and encourage them to change their behaviour, give security to investors in the energy and energy efficiency business, and to expand upon existing policies/projects. Ireland should be able to base a more targeted energy efficiency policy on:

- The comprehensive statistics and data base on energy use developed by Sustainable Energy Ireland (SEI).
- Policies and measures studied and assessed by SEI.
- The range of policies and measures identified in the Green Paper, as well as in the recently published Energy Efficiency Action Plan of the EU (EEAP).

The most promising programmes and actions to achieve additional energy efficiency improvements, which should be maintained or further developed are as follows:

- **Power generation:** Further energy efficiency improvements in the energy production sector by, for instance, expanding combined heat and power (CHP) production (Ireland still has one of the lowest CHP deployment levels in the IEA/EU, 2.4% of electricity generation in 2004), introducing waste-to-energy processes, such as in the peat sector, supporting Bord na Móna's strategy of diversification, and increasing the use of gas and renewables.
- **Industrial sector:** Extending the number of industry agreements under the Industry Energy Agreements Programme and LIEN (Large Industry Energy Network), and further promotion of Energy MAP (Management Action Programme) and of the new energy management standard (IS 393), as well as supporting additional energy efficiency gains through the establishment of a Carbon Fund and participation of the industrial sector in the EU-ETS (EU Emissions Trading Scheme).
- **Transport sector:** Full and rapid implementation of the Transport 21 Programme (mainly investment in infrastructure, such as in the road network and public transport), assessment/adaptation and further deployment of tax incentives, such as encouraging the purchase of cleaner/more efficient vehicles; fiscal measures to encourage sustainable travel behaviour; moving taxation from purchase/ownership of vehicles to their use), and support of technology development in the sector, such as R&D on second-generation biofuels.

- **Residential sector:** Implement/deploy/expand programmes such as House of Tomorrow, Greener Home schemes, the energy efficiency media campaign Power of One, and Building Energy Rating Certificates, as well as consideration of the introduction of an obligation scheme similar to the UK's Energy Efficiency Commitment, and the introduction of strict enforcement of building regulation requirements by ensuring that buildings are performing to standards.

SEI is the main delivery vehicle for the government's energy efficiency programmes and is responsible for the delivery of a wide range of programmes that will be critical to the success of the government's agenda in this policy area. SEI has developed successful energy efficiency marketing, building improvement and industrial campaigns, and this effort is highly commendable. Care should be taken to sustainably develop SEI to ensure its ability to deliver the government's ambitious programme.

To move energy efficiency forward, the government will have to consider the introduction of secure long-term funding to build up the delivery capacity of installer industries and the building sector. Once this has been achieved through a gradual increase in support programmes, wider-ranging measures should be developed and additional funding should be allocated.

The government and SEI should continue energy efficiency marketing efforts linked to the ISO 393 standard, and combine them with minimum efficiency product regulations and grant support where possible. Particular consideration should be given to the adoption of international initiatives, such as the IEA's 1-Watt Initiative on stand-by power use.

RECOMMENDATIONS

The government of Ireland should:

- *Set medium- and long-term targets to improve energy intensity, taking into account reduced carbon-intensity, with indicative sub-targets for each main energy-consuming sector, including transformation, showing to what extent energy efficiency in every sector might reduce external energy dependence and GHG emissions. Long-term funding programmes should support the achievement of these targets.*
- *Focus particularly on improvements of energy efficiency in the transport sector in a comprehensive approach involving all relevant departments and dealing with all aspects that promote more sustainable energy use in transport in all areas, such as infrastructure, land-use policies, technologies, support to low CO_2/more efficient vehicles, alternative fuels, adaptation of the tax system, and behaviour.*
- *Set cost-effective energy efficiency criteria in all public-sector projects, programmes and procurement, covering in particular the tax system, the housing policy, the transport sector and the energy production sector.*

RENEWABLES AND NON-CONVENTIONAL FUELS

OVERVIEW

Renewables contributed 0.39 Mtoe or 2.6% to total primary energy supply (TPES) in Ireland in 2005, an increase of 0.22 Mtoe, or 133%, compared to the 0.17 Mtoe supplied by renewables in 1990 (see Figure 11). This represents an increase of 45% compared to the 1.6% contributed to TPES in 1990, indicating that renewables supply grew faster than TPES. The increase was due to an increase of wind generation from no contribution in 1990, to 0.1 Mtoe in 2005, and in the use of combustible renewables and waste, which increased from 0.11 Mtoe to 0.24 Mtoe over the same period, by 124%. Hydro production decreased within the annual variation range, while hydro capacity in Ireland remained unchanged.

The government forecasts a continued rapid growth of the contribution of renewables by 2010, and foresees a stable contribution between 2010 and 2020. However, this forecast does not take recent policy proposals from the Green Paper 2006 (see Chapter 2) into account. Once these are taken into account, the contribution from renewables to TPES is expected to increase to 6% in 2010, a 202% increase in absolute terms on 2005. This is expected to increase by a further 93% on 2010 levels to 11% of TPES by 2020.

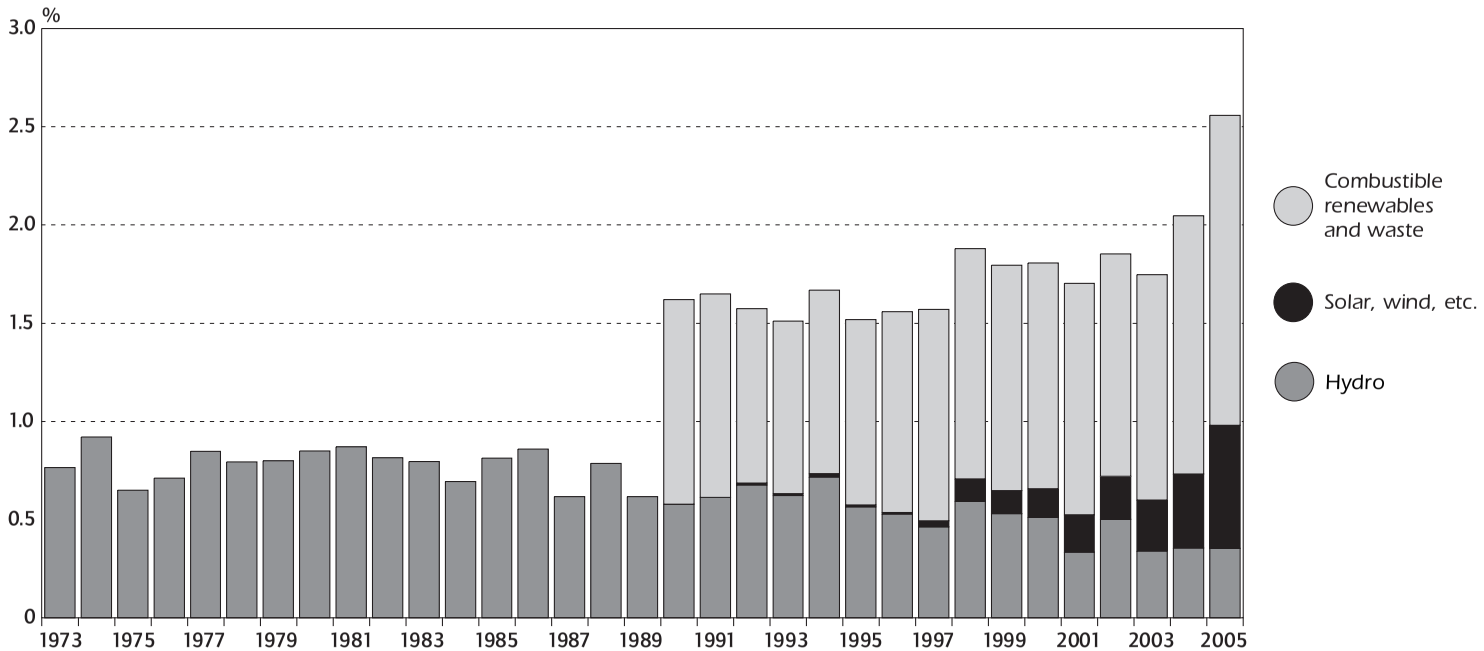
SOURCES OF SUPPLY AND DEMAND

Compared to other IEA countries, the contribution of renewables to TPES in Ireland has been low, despite an excellent resource potential for wind generation. The most important renewable technology is wind power harnessed in the electricity market. Electricity generated from renewables contributed 7.5% to electricity supply in 2005, up from 5.5% in 2004, and is expected to reach 9% in 2006.[7] This was achieved by a 70% rise in electricity generated from wind-powered plants following the removal of connection restrictions. Market interest for further extension, measured as connected projects and requests for connections in all renewable energy technologies, excluding large hydro, is of the order of 5 000 MW installed capacity, primarily onshore wind. This is driven by the very favourable economics of onshore wind

7. 2005 is the last available full-year for data.

Figure 11

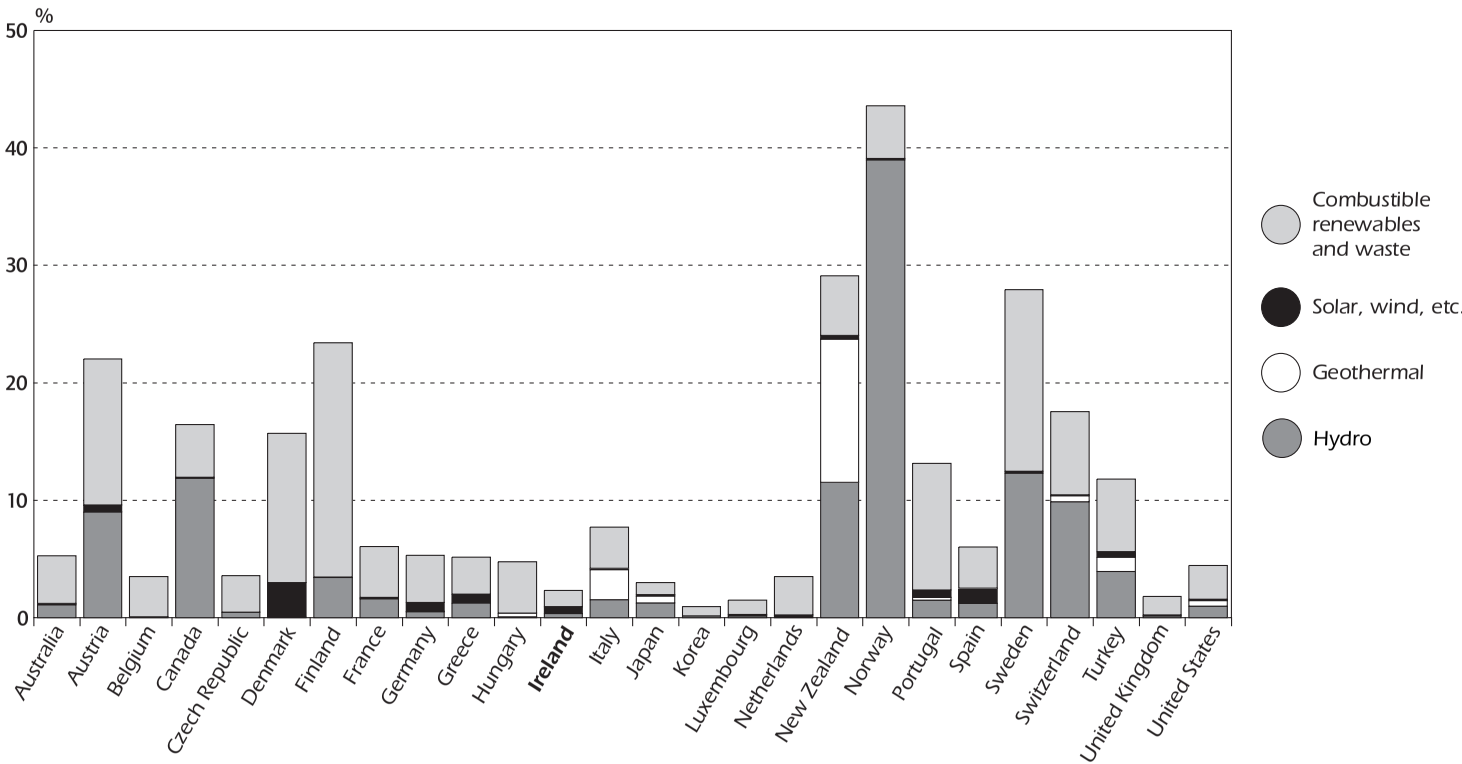
Renewable Energy as a Percentage of Total Primary Energy Supply, 1973 to 2005



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007.

Figure 12

Renewable Energy as a Percentage of Total Primary Energy Supply in IEA Countries, 2005*



* estimates.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007.

in Ireland. The government calculates[8] that there is in excess of 1 000 MW of renewable capacity connected to the national grid, measured by the installed generating capacity. This includes biomass (22 MW), landfill gas (29 MW), hydro (236 MW) and wind technologies (744 MW).

WIND

Wind generation has increased rapidly since the first Irish wind farm was commissioned in 1992. In 2003 the installed capacity of wind farms in Ireland was 169 MW, by the end of 2004 this had risen to 339 MW, increasing to 496 MW by the end of 2005 and had further increased to 744 MW at end 2006. Connection agreements for an additional 547 MW of wind capacity have been signed, and a further 1 292 MW of wind capacity is awaiting connection offers from the network operator during 2007. Connection applications for a further 1942 MW have been notified but are not yet the subject of signed offers.

Ireland has one offshore wind farm with 25 MW capacity, located at Arklow Banks. The government has also committed financial support to two new offshore projects under the Alternative Energy Requirement Round VI (AER VI, see box below). The current market interest is essentially for onshore wind generation and, owing to more favourable economics, the government has decided that this interest requires priority attention since it provides a lower-cost solution than offshore wind-parks.

BIOMASS AND BIOFUELS

Ireland has a limited biomass resource, given its nature of agriculture and limited forestation. The government has, however, presented policy proposals to significantly increase the use of biomass in electricity generation, by co-firing it in peat-fired power stations.

The biofuels market for transport has now been created with an excise tax relief policy initative for pilot projects in 2005. It is too early to identify a definitive trend for domestic biofuels production, although interest in the sector has focused on proposals to develop biodiesel facilities from feedstocks such as oil seed, rape and tallow. The government's target is to achieve a 2.2% biofuel penetration level by 2008, a level for which domestic biomass production should be sufficient. The government has announced the introduction of an obligation to reach the indicative EU target of 5.75% of renewables contribution by 2009 – a year in advance of the EU directive target – and a further target of 10% by 2020. The purpose of the obligation

8. January 2007.

is to provide longer-term certainty for market players, and to develop the biofuels market with a view to reducing oil import dependence, achieving emissions reductions and supporting rural economic development.

HYDRO

Hydro resources in Ireland are limited. The government estimates that with the currently installed capacity of approximately 240 MW, the large-scale resource potential is fully utilised. The government has developed a specific Ocean Energy Strategy, which is described in more detail in Chapter 8 on Energy R&D.

SOLAR

Small amounts of solar thermal and solar PV are installed in Ireland. These technologies currently harness or retain heat, or produce electricity at individual or isolated sites. Solar and heat pump technologies are supported through the domestic grants programme and through a commercial biomass heating grants programme, which is currently being redesigned to include other renewable energy technologies and to enable community and voluntary groups to access funding.

GOVERNMENT POLICY

OBJECTIVE

The government has stated as its main objectives in renewable energy policy that it intends to maximise the amount of renewable electricity from indigenous energy sources, thereby contributing to growth in electricity demand without compromising the system stability or price competitiveness; that it aims to increase the share of biofuels on the transport fuel market; and that it pursues an increased market share of renewable heat technologies in the industrial, commercial, public and domestic sectors. To achieve these objectives, it published a Green Paper on energy policy in October 2006 (see Chapter 2), proposing specific targets relating to each of the objectives. It has also begun to implement support policies that should lead to the achievement of the targets.

TARGETS

Under the EU Renewables Directive (2001/77/EC), Ireland was set an indicative target of 13.2% renewables contribution to gross electricity consumption by 2010. In the 2006 Green Paper, the government consulted on

new, more ambitious targets for renewable energy development in the electricity and biofuels sectors in Ireland. There are no output-related targets for renewable heat, but a number of measures are already in place to increase market penetration of renewable heat technologies, and targets relating to the number of installations. The targets proposed in the Green Paper are as follows:

- IncreasIn the electricity market, to increase the contribution from renewable energy sources to electricity consumption from a benchmark of 3.6% in 1997 to 15% by 2010, and 30% by 2020.
- IncreasIn the transport sector, 2.2% market penetration of biofuels by 2008, with further targets for 2010 and beyond under consideration.
- IncreasIn thermal applications, to deliver up to 600 wood chip installations in the commercial and public sector and to convert over 10 000 homes to the use of renewable heat technologies.

POLICIES AND MEASURES

Renewable Electricity

The main instrument to support electricity production from renewables is now a banded feed-in tariff (REFIT), following a policy decision to change from a competitive tendering scheme (see box below). The REFIT for wind-generated electricity from large-scale wind farms, above 5 MW installed capacity, is set at EUR 0.057 per kWh produced. This is a level which is currently below the reference price for electricity required by a new unamortised conventional plant. The REFIT is calculated to support bank borrowing of 80-90% of the capital cost for a renewable installation at least cost by minimising commercial risk. Additionally, tax relief is in place to assist developers to source the remaining 10-20% of their capital requirements.

The Renewable Electricity Feed-In Tariff (REFIT) and the Alternative Energy Requirement (AER)

In May 2006, the government changed its support policy for renewables from a competitive tendering approach to a feed-in tariff approach. At the time, six rounds of tenders under the AER had been held. The reason for the change of the support system was a realisation that under the AER, a significant amount of wind capacity from successful bidders had not been built, and was unlikely ever to be built. The primary cause for this failure was identified as "winner's curse", *i.e.* developers had bid too low in order to win a contract, and only afterwards realised that they

would not be able to operate at a profit at the price they bid. This experience is similar to that of the UK with the Non-Fossil Fuels Obligation tenders, which were held in the 1990s.

Given the situation in the Irish market, where ESB is the dominant producer of electricity, it was seen as unlikely that a green certificates scheme, such as the Renewables Obligation in the UK, would have significant benefits, at least in the short-term, and also that it would not further the government's aim to increase the number of small, independent wind farm operators. Based on this analysis, and the EU report[9] comparing the efficacy of various renewables support schemes, the decision was made to introduce a feed-in tariff scheme.

The characteristics of the REFIT scheme are the following:

- Stable and consumer price-indexed feed-in tariff offered to qualifying developments[10] banded by type of technology:
  - Large-scale wind category – EUR 57 per MWh.
  - Small-scale wind category – EUR 59 per MWh.
  - Hydro – EUR 72 per MWh.
  - Biomass landfill gas – EUR 70 per MWh.
  - Other biomass – EUR 72 per MWh.
- Capacity limitation to 400 MW (later raised to 620 MW) total additional renewables capacity.
- Time limitation to 15 years per contract.
- Time limitation for access to the REFIT of 2009 and the associated support cannot continue beyond 2024 in any contract.
- Developers have to negotiate supply contracts independently.

The estimated additional cost for the first 400 MW of capacity was EUR 119 million. The rules of REFIT allow the government to extend the capacity limitation by public notice. In order to qualify for REFIT support, projects must have a valid planning permission and a network connection

9. "Communication from the European Commission - The support of electricity from renewable energy sources {SEC(2005) 1571}.
10. Qualifying developments are developments which fulfil the following conditions:
    - The plant must be a "new electricity generating plant". This is defined as a generating plant which is neither built nor under construction on 30 April 2005 and which uses only renewable energy resources, these being onshore wind, biomass (which may co-fire 10% fossil fuels) or hydropower;
    - The project must have received full planning permission unless the applicant can prove that planning permission is not required;
    - The generator must have received a connection offer which must not have expired;
    - The generator must demonstrate that title has been obtained to the relevant site for a period equal or longer than the duration of the power purchase agreement (PPA).

offer. Thereafter, projects are required to proceed promptly, and the projects selected under the REFIT are reviewed regularly for progress. Proposals that fail to meet their milestone targets are likely to have the offer of support withdrawn.

The REFIT banded support prices are based on an analysis of the bid prices of projects built under the previous AER support programme. The REFIT offers much less generous terms than similar schemes in other IEA member countries. The main reason for this low price is very high wind resources in Ireland, which allow wind farms to reach annualised load factors of 33% to 35%, and a medium load-factor across all wind-powered developments of 34%. This is far higher than the amount of electricity generated by wind farms in other IEA member countries, and significantly enhances the ability of Irish wind farms to operate at a profit even at a low feed-in tariff.

Under the REFIT scheme, renewables developers negotiate power purchase contracts with an electricity supplier independently, and on a commercial basis. The electricity supplier must enter into the contract for a minimum length of 15 years. The contract must offer a fixed price for all electricity produced, irrespective of the prevailing price of electricity in the open "top-up and spill" market. This transfer of a revenue risk from the electricity producer to the purchaser is more attractive to investors in renewable energy projects and minimises the debt servicing cost for project developers. Debt servicing can be as high as 66% of annualised costs, which impacts significantly on average production costs.

The supplier is compensated for the average difference between the cost of purchasing at EUR 57 per MWh (the large-scale wind price) and the estimated costs it would incur purchasing and selling excess dispatchable power in the current top-up and spill market, a precursor to the planned pool market. The REFIT programme calculates this difference as the cost of balancing undispatchable power at EUR 8.5 per MWh payable to participating suppliers. In addition, suppliers contracting with the higher-cost technologies are compensated for the additional cost incurred above the large-scale wind price, *i.e.* EUR 59 to EUR 57 per MWh for small-scale wind projects, EUR 70 to EUR 57 per MWh for landfill gas projects, and EUR 72 to EUR 57 per MWh for small hydro and other biomass.

Stationary Use of Biomass

A number of stationary biomass installations have taken place. Between October 2005 and October 2006, eleven hotels and 14 other businesses migrated to wood energy heating, with further installations coming on stream as a result of the Bioheat grants programme. In the residential sector,

11 500 applications were received for grant support for renewable heat installations (including biomass, solar and heat pumps) during 2006.

A grant programme for stationary use of bioenergy was launched in June 2006, for biomass heating in the commercial and public sectors. By the end of 2006, it had committed almost EUR 600 000 to 29 projects. The programme offers EUR 26 million over the next four years. The scheme provides grants of up to 30% of the overall cost for the purchase and installation of wood chip or wood pellet boilers. It is currently being expanded to allow community and voluntary groups to avail of funding and to include other technologies, such as solar.

A CHP programme including large biomass CHP was launched in August 2006. By the end of 2006, it had committed almost EUR 400 000 to nine projects. The first call for proposals restricted to biomass CHP is to be launched during the first quarter of 2007.

The five-year "Greener Home" residential grants programme was launched in March 2006 and has a budget of EUR 47 million. The programme provides flat-rate differentiated grants to householders towards the cost of purchasing renewable heat technologies, such as biomass, solar and heat pumps. In 2006, 11 500 applications were received with potential financial commitments of EUR 37 million, and it paid over EUR 4 million in support of the installation of 1 339 systems. By its final year, the scheme is expected to displace 8.6 million litres of oil per year. This is equivalent to meeting 100% of the heating needs of 7 100 homes from renewable energy, and will save 23 000 tonnes of CO_2 per year.

The residential market is also serviced by grant programmes for developers of groups of housing, to which funds are provided where the housing units demonstrate the use of technologies or practices that go beyond existing building regulations and often include the installation of renewable energy technologies. The programmes aim to reduce CO_2 emissions by over 180 000 tonnes per year[11] when they are fully rolled out, and they will also contribute to security of supply through fuel diversification. The government expects that the schemes will assist in the development of the biomass processing and renewable energy services sectors.

Biofuels for Transport

The Biofuels Mineral Oil Tax Relief Schemes I and II provide relief from excise duty on a competitive basis for specific projects which place biofuels on the fuel market. A further support programme involving grant-aid for

11. This figure is subject to revision, because of recent increases in funding.

capital requirements is also being developed. This excise relief is estimated to cost the government EUR 219 million in excise duties forgone over the five-year lifetime of the two schemes. The government sees this measure as an enhancement of security of supply by reducing Ireland's dependence on imported fossil fuels for transport, where it is currently 100% dependent, and also hopes to encourage the development of an indigenous biofuels sector. The scheme is estimated to save 1.2 $MtCO_2$ emissions over the lifetime of the programme, indicating a cost of EUR 180/tCO_2 abated. Developers' interest in the second support scheme has been very high and 16 projects have now been approved across four categories of biofuels, including bioethanol, biofuel complying with diesel standard EN590, biodiesel in captive fleets and pure plant oil. Successful applicants will be required to report on progress every six months and excise relief can be withdrawn if specific targets and deadlines are not met within a reasonable time frame. The government has now announced that it will introduce a biofuels obligation by 2009 and has established biofuels market penetration targets of 5.75% by 2009 and 10% by 2020, which will be achieved through this obligation.

PLANNING RULES, NETWORK CONNECTIONS AND SYSTEM INTEGRATION

PLANNING RULES

All renewable energy projects which require planning permission must comply with the applicable planning rules. In order to qualify for the REFIT, a development must have planning permission. Permission expires after a set period of time, usually five years, which has become a cause of concern for some developments affected by the 2003 moratorium (see below). In 2006, the Department of Environment, Heritage and Local Government (DoEHLG), which is responsible for planning, published new guidelines for wind farms in Ireland, which are expected to facilitate wind farm siting and construction. Since 2006, applicants for new planning permissions are advised to include a request for a planning decision valid for ten years rather than five, the typical period sought previously. New planning guidelines for micro-renewables were published during 2007.

Unlike in some IEA member countries, planning has not been an issue in Ireland, where there are no widespread concerns about the increase in renewable energy developments, in particular wind energy. The government is pursuing an active approach to try and ensure that this positive public attitude will not change. SEI is supporting this through various efforts, including a series of conferences, which bring together planners and wind farm applicants.

NETWORK CONNECTIONS

The main factor restricting wind capacity development in Ireland has been the constraint on the electricity grid in connecting significant amounts of non-dispatchable generating capacity. The Irish electricity grid is already weak in the rural west and north of the country, where the most suitable wind-powered plant sites are located. This weakness is exacerbated by the isolated nature of the grid. At the request of EirGrid, the Commission for Energy Regulation (CER) imposed a moratorium on connections in late 2003, to ensure the continued safe operation of the grid. To accelerate the connection process following the lifting of the moratorium, wind farm applications were grouped on a regional basis, with connection costs shared according to capacity, under the so-called "Gate" process. Gate 1 included all pre-moratorium applications, a total of 620 MW of wind capacity. Gate 2 includes all subsequent applications, and covers applications with a capacity of 1 300 MW. Currently, only Gate 1 applications can benefit from the REFIT. Owing to delay, a number of Gate 1 applications are now in danger of exceeding the time limit for planning permission.

To ensure the long-term development of the grid in line with the policy proposals for a significant increase in renewables, the government and the Northern Ireland Executive are now jointly undertaking a major grid study, which considers how the proposed significant increase in renewables developments up to 2020 and beyond can be accommodated.

SYSTEM INTEGRATION

The rapid growth of wind generation in Ireland, together with the isolated nature of the Irish grid, is putting EirGrid and the future all-island transmission system operator in the forefront of system integration expertise regarding wind generation. Figure 13 shows the performance of wind generation compared to system load on selected days, compared to the annual or monthly mean output, indicating the management challenge for EirGrid, as well as the potential for wind generation to contribute to the system management, depending on how wind speeds develop.

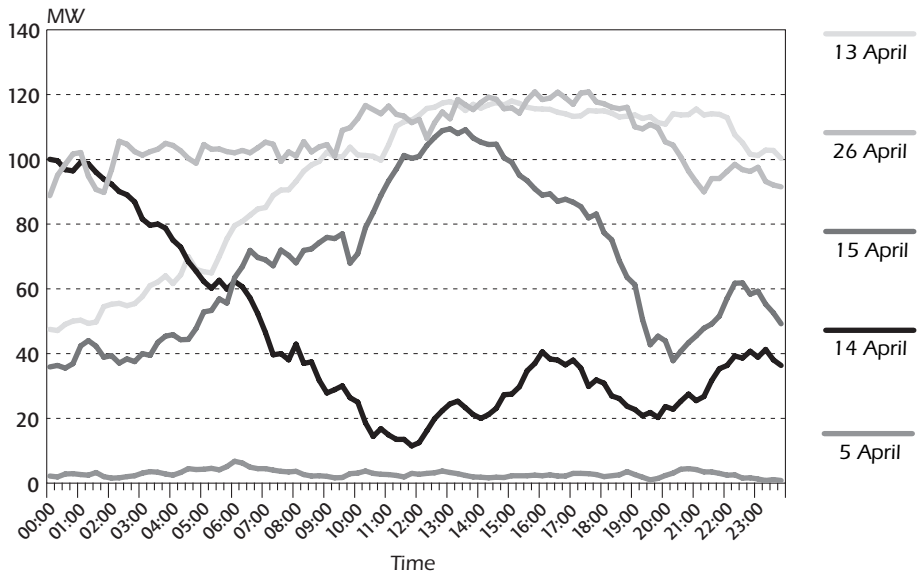
Given the high demand for new connections by wind power project developers and the limited potential for interconnection, system integration concerns are expected to be an important constraint on the development of wind power in Ireland. The current level of interest in wind farms will necessitate the reinforcement of the grid and the construction of significant amounts of backup generating capacity. Some proposals have been made to address this problem, and research on storage methods is considered to be of very high importance by SEI. As an interim solution, the conversion of public transport to electricity has been proposed for the west of Ireland. This would allow the

construction of additional wind capacity, with the unused surplus output available to replace liquid fuel requirements for buses after the completion of appropriate pilot studies.

A consensus exists that to achieve the 2020 target of 30% of gross consumption in the electricity market, research and development (R&D) of dispatchable renewables capacity and storage solutions will have to be prioritised (see Chapter 9 on Energy R&D).

Figure 13

Wind Power Output in the Irish System: Selected Days April 2006



Source: EirGrid.

CRITIQUE

Ireland has made commendable progress in developing the renewable energy sector and increasing renewables deployment since the last IEA in-depth review, and the intent of the government is to continue to rapidly increase the use of renewable fuels in electricity, heat and transport. At the time of the last review, the deployment of renewable energy in Ireland was one of the lowest in the EU, and it is still comparatively low. Nevertheless, it is growing rapidly and the contribution from renewable energy sources to electricity consumption had increased to approximately 9% by the end of 2006. With the recent Green Paper *Towards a Sustainable Energy Future*, the government has announced new targets for renewable electricity for 2010 and 2020, of 15% and 30%

respectively. The 2010 target is considered to be easily achievable with wind power, while the 2020 target is ambitious and will depend on innovation and deployment of more dispatchable renewables capacity, and the availability of sufficient renewable fuel resources, such as biomass.

As Ireland is the EU country with the most economic potential for wind generation, it is not surprising that until well beyond 2010 onshore wind will remain the dominant technology for power generation from renewables. It has to be kept in mind, however, that offshore wind and biomass have considerable technological potential by 2020, even though this implies a higher cost and the need for additional investment in the power grid.

The achievement of the 2010 and 2020 targets can significantly contribute to the reduction of greenhouse gas emissions in Ireland. It will also play a crucial role in improving the security of supply by increasing diversification in the fuel mix and developing quite a large base of domestic energy supply. Nevertheless, it should be kept in mind that pursuing these aims with renewables is inherently more expensive than pursuing them with energy efficiency policies.

To achieve these aims, a renewable electricity support programme was established in the 1990s. Following negative experiences with the build-rate of developments that received a contract under this programme, the competitive tendering procedure was recently changed to a feed-in tariff approach, with the aim to assist project developers to source debt from the capital markets, thereby increasing the number of small, independent developers.

The government has output-related targets for renewable electricity and transport fuels. A target of 5% of heat to come from renewable sources by 2010 has been established in the Green Paper and a further target will be established for 2020. The government's approach to setting challenging targets, while keeping cost impacts in mind, is commendable, because these targets will give the Irish renewables industry long-term certainty about the framework within which it can develop.

When making the decision to switch support mechanisms for new projects on renewable energy in the electricity market, the government conducted a thorough policy analysis, with the aim of learning from the experiences with different support mechanisms in other countries. In doing this, the government also considered the drawbacks of feed-in tariff schemes in some other countries, such as an absence of time or volume limitations, or significant premiums above the reference price for electricity from a new conventional plant. The REFIT as implemented avoids these shortcomings by limiting capacity, duration and setting a price that is currently below the reference price because of the high costs of energy inputs which prevail currently in the conventional market. The government was able to take this approach because of the great potential for renewables deployment in Ireland. Both the intent and the implementation of the REFIT are

commendable, considering the current situation in the Irish electricity market, where a green certificates scheme would have reinforced the market dominance of the Electricity Supply Board (ESB). Nevertheless, the government should continue to closely observe the development of competition in the Irish electricity market, especially considering the move to an all-Ireland market, and should be prepared to revisit the decision about a green certificates scheme as an alternative support scheme once the dominance of the ESB has sufficiently reduced. However, any proposal to change the support mechanism should be influenced by the potential uncertainty any proposed change may generate, and providing any such change will not result in undue or avoidable costs for customers.

A condition for the long-term success of the development of renewables in Ireland is the development of the REFIT scheme, or a support scheme replacing it, into a stable, predictable and long-term support mechanism beyond the Gate 1 developments to which it currently applies. The success of the government's strategy is, however, not only dependent on the REFIT, but also on solutions which must be found to remove a number of remaining constraints on renewables development. The most important of these are related to the capacity of the grid to integrate wind power and also the required backup capacity, as well as the day-to-day issues of system integration of large volumes of wind generation in a small-island system.

A study concerning the all-island grid is expected to provide options to address this crucial question. Another important issue concerns the planning and connection permission process, under which individual developments are grouped on a regional basis in so-called "gates", to allow regulatory approval of grid access for several projects together. This system, together with the 2003 moratorium on wind connections, is creating delays in project implementation. The 2003 moratorium introduced a significant development risk in the Irish renewables sector, and the Irish government should take care to avoid a stop-start situation in developing renewables capacity in Ireland. The future development of the Irish renewables industry will be best served by a steady ramping-up of projects to achieve the long-term targets, instead of a situation in which a large number of new projects clog the system for a long time, followed by an absence of support for new proposals until the system has integrated the projects that were blocked under the moratorium.

In particular regarding system integration, Ireland will be at the forefront in developing solutions for power grids in many other IEA member countries. It would be desirable for the Irish regulator and the TSO to widely share their experiences in developing solutions to this challenge.

A five-year grant programme for renewable heating in the commercial and public sectors provides support of up to 30% of the overall cost for the purchase and installation of wood chip or wood pellet boilers, solar or heat

pumps. Additional measures have been taken to promote renewable heat technologies in the residential market. These schemes are commendable, since they provide an incentive for a domestic installer industry of biomass heat applications to develop. Also, the support for these installations is particularly valuable in Ireland, where a large part of the population does not have access to natural gas, and relies on oil, electricity or peat for heating. Biomass heat has the potential to provide an economic alternative to an extension of the gas network in sparsely populated regions of the country.

The renewable heat programmes for the residential sector will reduce dependence on fossil fuels and offer increased choices for businesses and consumers, including access to lower-cost fuels. Without these schemes, the capital costs of installing renewable energy technologies, such as biomass heating or solar thermal heating are expected to be prohibitive. The Reheat and Greener Home programmes are monitored on a monthly basis to assess take-up.

In the transport sector, a fiscal support scheme has been adopted to promote biofuels to achieve a contribution of 2.2% biofuels by 2008 and the indicative EU target of 5.75% by 2010. The decision to restrict the initial target to 2% was based on the desire to allow an indigenous biofuels industry to emerge. Such an aim would, however, have been counterproductive to the competing policy requirement to reduce the oil dependence of the Irish economy (see Chapter 7) and to diversify supply sources. At the same time, it is highly doubtful that a domestic biofuels industry will add much to indigenous energy supply given the competition for scarce biomass resources, which could supply at most 2-3% of transport fuel demand. It is therefore commendable that the government has moved towards an obligation system for the achievement of the next stage of biofuels targets which, at 5.75% (2009) and 10% (2020), exceed the indigenous feedstocks available and should therefore provide market conditions that encourage the maximisation of domestic resources, alongside a further level of imports. The government should however ensure that the cost per tonne of CO_2 abated is reduced significantly, compared to the current tax exemption.

RECOMMENDATIONS

The government of Ireland should:

- *Assure a predictable and stable long-term incentive mechanism for the different renewable energy technologies available by 2020. Special consideration should be given to the development of fair and coherent cost-effective support initiatives coupled with streamlined and standardised interconnection procedures for renewable electricity technologies. In the case*

of biomass in particular, there is a need to develop a co-ordinated strategy to achieve the optimal use of biomass resources at acceptable cost.

- *Further efforts should be made to fully address intermittency issues of wind power to ensure supply reliability and adequacy, as well as cost-effectiveness, taking into account the requirement for flexible grid management systems. This can be supported by the existing gate procedure, which enables a more efficient integration of wind power into the grid by grouping wind developments in order to upgrade the grid more efficiently.*
- *Analyse the complete cycle of production of biofuels in terms of CO_2 emissions and energy consumption in order to decide if their promotion contributes to the renewables strategy or only to the aim of security of supply.*

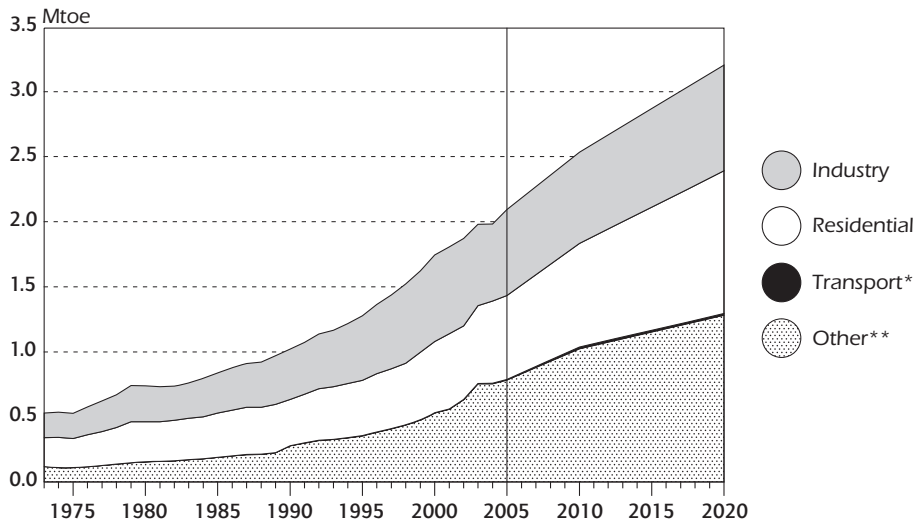
OVERVIEW

With a relatively small population, Ireland's electricity sector is limited in terms of customer base (2 million) and load (25 233 GWh in 2005); however, growth in electricity demand has been among the highest in OECD countries, fuelled by a rapid increase in population and economic growth. As Figure 14 shows, final consumption in all sectors has steadily increased, with the residential sector providing the major impetus for growth over the period to 2020.

Peak demand reached a record 4 828 MW in December 2005, an increase of 6.6% over the previous peak recorded in December 2004. Over the 1990-2000 period peak demand grew at 4% per year. EirGrid, the Irish transmission system operator (TSO), projects an annual 3.8% increase in peak demand over the 2005-2011 period.

Figure 14

Final Consumption of Electricity by Sector, 1973 to 2020



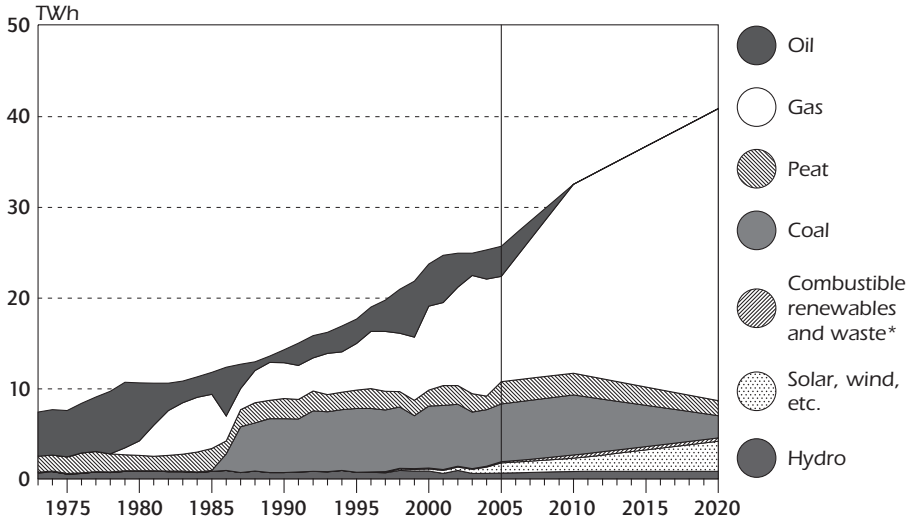
* negligible.

** includes commercial, public service, agricultural, fishing and other non-specified sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

Figure 15

Electricity Generation by Source, 1973 to 2020



* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

Table 10

Electricity Generating Capacity by Fuel, 2005

Fuel	*MW*	*Share of installed MW in %*	*Ownership*
Gas	3 111	45	62% ESB
Coal	858	13	100% ESB
Oil	1 014	15	100% ESB
Dispatchable hydro	508	7	100% ESB
Peat	346	5	65% ESB
Non-dispatchable	1 007	15	Dispersed Ownership
Total	**6 843**	**100**	

Source: CER.

INDUSTRY STRUCTURE

GENERATION

As Table 10 shows, installed generating capacity totalled 6 843 MW by year-end 2005. There are six major generating companies, namely ESB Power Generation (ESB-PG), Viridian PLC, Tynagh Energy Ltd., Aughinish Alumina, Edenderry Power Ltd. and Synergen (70% owned by ESB). The state-owned ESB's portfolio of plants accounts for 66% of total capacity, including all mid-merit and peaking plants, giving it a dominant position in the market.[12] Capacity of non-dispatchable plants amounts to 1 007 MW, mostly independently-owned.

Recent years have seen new capacity additions mainly in gas-fired facilities and wind power. This trend is consistent with other IEA countries. As a result of an open competition held in 2003, two gas-fired projects came on line in late 2005, namely a 148-MW co-gen plant at Sealrock and a 382-MW CCGT plant at Tynagh. In June 2004, the government announced the refurbishment of ESB's coal-fired plant at Moneypoint, to be completed by January 2008 to comply with the EU Large Combustion Plant Directive. Furthermore, a 400-MW CCGT plant is under construction outside Dublin and is expected to be commissioned in late 2007/early 2008. By the end of April 2006, connected wind generation amounted to 58 MW, compared to 642 MW of signed connection offers; 63 MW of connection offers were issued and 3 072MW are associated with applications in process.

To meet high electricity demand growth, electricity generation has increased substantially over the last 20 years (see Figure 15). Coal used to be the most important fuel source for power generation, but is now surpassed by natural gas, which accounts for about 45% of the generation mix in 2005. Incremental demand in the last decade has been primarily met by gas as in many other IEA European countries, such as the UK, Italy and the Netherlands. Overall, Ireland has a very high and increasing dependence on fossil fuels for its power generation, which currently accounts for close to 92% of its total generation. The use of peat in power generation reflects the government objective to maximise the use of local energy resources. The government estimates that between 8 300 and 19 000 GWh could be generated from renewable sources by 2020. Although wind power will likely dominate the renewable mix, potential may exist in other renewable energy technologies, such as biomass and ocean power.

12. ESB's plants set the market-clearing price in 99% of hours in the period January to June 2005 according to EirGrid's *Quarterly Review*.

Table 11 shows relatively low availability factors for the period 2001-2005, with a record low in 2003. In its most recent Generation Adequacy Report, the Irish TSO concluded that there has been considerable volatility in the performance of plants in the last 12 years. Analysis by the TSO indicates that overall system availability has been affected by particular plants which have been performing consistently poorly over the past years.

Table 11

Power Plant Availability Factors, 2001 to 2005

Year	*Availability*	*% forced out*	*% scheduled out*	*Share of forced out of total unavailable*
2001	87.35	8.15	4.51	64
2002	83.46	10.74	5.79	65
2003	76.54	14.87	8.59	63
2004	80.87	11.43	7.7	60
2005	82.27	11.3	6.42	64
Average	*82.1*	*11.3*	*6.6*	*63*

Source: CER.

TRANSMISSION

The Electricity Supply Board (ESB) currently owns the electricity transmission networks and also owns and operates the electricity distribution system. In 2001, the Commission for Energy Regulation (CER) issued a transmission asset owner (TAO) and a distribution system operator (DSO) licence to ESB Networks. A transmission system operator (TSO) licence was granted to EirGrid. An Infrastructure Agreement, outlining the establishment of a fully independent TSO, EirGrid, as an independent state-owned entity, was formulated in 2001 and was fully implemented in July 2006. While EirGrid determines any investment projects to be undertaken, ESB, as transmission asset owner, undertakes the work.

The transmission network includes 6 215 km of overhead high-voltage lines (mostly 110 kV, 220 kV and 400 kV) and 120 km of underground cables. The Transmission Forecast Statement published by the TSO highlights locations where the transmission system is capable of accommodating new generating capacity. Electricity-related infrastructure is subject to the Planning and Development Acts and requires permission under these. Provision is made in

the Planning and Development (Strategic Infrastructure) Act 2006 for a streamlined planning process for high-voltage transmission lines. Certain other large projects such as generation stations may also apply through a special Strategic Infrastructure Unit established under this act.

CROSS-BORDER TRADE

The national grid is interconnected with Northern Ireland (NI), which is in turn interconnected with Scotland via the Moyle submarine interconnector. The north-south interconnector has a net transfer capacity of 330 MW in a north-south direction. In recent years the take-up of capacity in a south-north direction has been close to zero even though the net transfer capacity in that direction has been 170 MW. All "north-south" capacity to date has been allocated on a yearly product basis. Although capacity to export exists, exports to NI were negligible. The interconnection is mainly used to import electricity from NI. For the period March 2005 to April 2006, total imports amounted to 2 425 816 MWh, accounting for 8% of total electricity consumption.

The interconnector connects Louth station to Tandragee in County Armagh (NI). The physical interconnection consists of three 220/275 kV transformers in Louth station, connected to a double-circuit 275 kV line (2×600 MW). In addition to the main 220/275 kV interconnector, there are two 110 kV connections, with the purpose to provide support to either system in certain conditions or in the event of an unexpected circuit outage. Phase-shifting transformers are used to control the power flow under normal conditions.

In November 2004, Ireland and NI endorsed plans for a second north-south 450 MW electricity interconnector. This is intended to form a significant part of the robust infrastructure that is required to meet the needs of the new all-island single energy market (SEM – see box below) and enhance security of supply. In April 2005, the CER authorised EirGrid to proceed to carry out the work necessary to obtain planning permission for this interconnector, expected to become fully operational by 2012.

DISTRIBUTION

The former incumbent, ESB Networks, currently owns and operates the electricity distribution network. ESB Networks has approximately 2 million customers of which approximately 1.8 million are domestic. Total sales in 2005 amounted to 23 380 GWh. Sales by customer category are presented in Table 12.

Table 12

End Customer Class and Load by Connection Type

Category	*Load in GWh*	*Customers*	*Share of load in %*	*Share of Customers in %*
Urban domestic	4 630	1 047 206	19.8	53.426
Rural domestic	3 532	727 809	15.1	37.131
Low-voltage small business	4 073	174 066	17.4	8.880
Low-voltage medium-sized business	3 330	9 739	14.2	0.497
Medium-voltage	4 855	1 194	20.8	0.061
38kV	804	61	3.4	0.003
110kV	2 156	20	9.2	0.001
Total	**23 380**	**1 960 095**	**100.0**	**100.000**

Source: CER.

Table 13

Interconnector Trade

(April 2005-March 2006)

	MWh
Exports to NI	315 481
Imports from NI	2 425 816

Source: CER.

MARKET REFORM

POLICY

Ireland's electricity market reforms have been driven by the need to comply with the EU's directives and the pursuit of its own national policy objectives. The key EU requirement is the Electricity Directive 2003/54/EC. Key national legislation includes the Electricity Regulation Act, 1999, the European Communities (Internal Market in Electricity) Regulations 2000 and 2005. In the pursuit of sustainable development, the government has established the following specific objectives:

- Development of a SEM with NI.
- Development of an east-west interconnector with the UK and a second north-south interconnector with NI.
- Commitment to reach 15% of renewables consumption by 2010.

In recent years, Ireland has moved away from a vertically integrated monopoly to an increasingly competitive electricity market, the goal being to integrate all

the key features of competitive markets into the SEM by November 2007. The liberalisation process started in 2000 and gradual market opening during the transition period (see below) has resulted in full market opening in February 2005. By mid-2005, approximately 30% of the retail electricity market (by volume) in the industrial and commercial segments was served by suppliers other than the incumbent utility ESB Public Electricity Supply (ESB PES).

Features of the Single Electricity Market

The establishment of a Single Electricity Market (SEM) is planned for November 2007. In August 2004, the CER concluded a Memorandum of Understanding with the Northern Ireland Authority for Energy Regulation (NIAER) to develop an all-island energy market, which will merge the energy markets in the Republic of Ireland and NI. This will introduce a strong competitor to ESB into the market, leaving the Irish market a duopoly. The first step towards achieving this is the development of a single wholesale electricity market. Table 14 compares key features of the SEM and the current wholesale market.

Table 14

Comparison of SEM (from 2007) and Transitional Market (1999-2007) Design

Design characteristic	*Transitional market*	*SEM*
Market model	Bilateral trading (generators trade directly with suppliers)	Gross mandatory pool (all electricity is sold and bought from a central pool)
Generator dispatch	Decentralised dispatch (generators determine their own running schedule)	Centralised dispatch (system operator dispatches the most efficient plant to meet demand)
Market prices	Regulated top-up and spill prices	Prices set by the market at the marginal cost of energy
Capacity payments	Capacity component included in spill prices	Explicit capacity payments based on availability
Settlement time frame	Monthly settlement for energy	Weekly settlement of energy to facilitate a reduction in security cover provisions
North-south transmission connection	Treated as an interconnector	Deemed to be part of a single transmission system

TRANSITIONAL MARKET (1999-2007)

In 1999, a policy direction established a bilateral wholesale market where participants can trade energy and balance out their uncontracted energy needs with ESB Power Generation (ESB PG), the incumbent power generation company. Thus, a regime for the provision of top-up (energy shortfalls) and spill (excess energy) was created and the CER introduced a code to govern all transactional aspects of the wholesale market, entitled the Trading and Settlement Code. All market participants wishing to operate in the market must sign up to, and are bound by, this code.

Market power is often a key issue and concern for electricity market reform. To address this issue, the market power of the incumbent, ESB, is currently monitored through wholesale and retail regulations, through licensing and via wholesale market rules. The CER monitors this behaviour on an ongoing basis (including review of monthly reports from the incumbent) and licenses the incumbent, which requires ESB to act in a certain manner, with the inclusion of conditions to specifically address the issue of behaviour and the prevention of anti-competitive behaviour.

Owing to a lack of independent generating capacity, the CER has organised in recent years capacity release measures in the form of the Virtual Independent Power Producer (VIPP) auctions, in lieu of breaking up ESB's power generation portfolio. These auctions offered additional capacity to licensed suppliers to service customers in advance of new generation plant becoming available. The ultimate goal of such arrangements is to increase competition in the generation sector while encouraging market entry for new generators. The VIPP auctions concern conventional thermal generation while the Green VIPP (GVIPP) concerns renewable power. The CER has run six VIPP auctions and two GVIPP auctions to date. The most recent VIPP auction was held in November 2005 and resulted in 200 MW of generating capacity being made available to the market. The most recent GVIPP auction took place in June 2006 and concerned the auction of 190 MW of green electricity. There were four successful bidders in this auction process.

Similar to the situation for generators, suppliers are governed by the Trading and Settlement Code and also by the terms and conditions set out in the supply licence. Given the nature of the market (currently suppliers do not bid into the market), there are no rules concerning their bidding behaviour. Suppliers will generally engage with generators through bilateral contracts, which are not regulated by the CER. Suppliers are, however, bound to honour rules concerning imbalances, settlement, security cover, interconnector nominations and appropriate reporting requirements.

In 2001, the CER licensed ESB as transmission owner and distribution operator. Under these licences, ESB is required to separate these network businesses legally and by accounting procedures from its affiliated supply and

generation businesses. This separation process was fully complete by the end of 2005. The TSO, EirGrid, was established in 2001 and was fully separated from ESB in June 2006. Furthermore, ESB PES is functionally separated from ESB Networks as DSO and TAO, and from EirGrid as TSO. To make unbundling effective, in April 2006 the CER issued and published a temporary Public Electricity Supplier Licence and a Power Generation Licence for ESB's PES and PG businesses. These licences introduced new ring-fencing arrangements, which cover the disclosure of information between the two businesses, between the two businesses and the regulated network businesses, and between the two businesses and the board of ESB.

Regulation of ESB's Contract Structure

The CER regulates the sale of electricity from ESB PG to ESB PES, and in turn from ESB PES to the final consumer. A cost-based regulation of ESB PG has been achieved in the past via an arrangement known as the Bulk Power Agreement (BPA). Under the BPA, the revenue that ESB PG was allowed to recover from ESB PES was calculated as ESB PG's total allowable costs, less ESB PG's regulated market revenues. The CER is required to ensure that ESB can satisfy the demand for electricity from its customers, in the first instance from ESB PG's portfolio of power stations.

With the signing of European Communities (Internal Market in Electricity) Regulations 2005 (SI 60 of 2005), the regulation of ESB PG was given a new legal basis from February 2005, the date of full electricity market opening. Regulation 3 of SI 60 of 2005 enables the CER to continue to put in place arrangements it deems appropriate, which have the effect of securing the extent to which ESB PG's generating stations supply electricity to ESB PES and other licensed generators or suppliers. ESB PES is also required to purchase electricity at the best effective price available in the wholesale market. Given the short period of time left until the introduction of the SEM in November 2007, CER regards the continuation of the existing approach to the regulation of ESB PG's costs as the most prudent approach to be followed until then.

Source: CER.

As part of an overall approach to mitigate market power, the two regulatory authorities (RAs), namely the CER and NIAER, will direct the predominant generators to make contracts available on an equal basis to all suppliers located in each jurisdiction. These contracts will place all suppliers on an equal footing with respect to supply from existing generation. Only a certain proportion of the output from the dominant generators will be subject to these directed contracts. The amount will be directly related to the extent to

which the market power of the dominant generators needs to be curtailed to ensure that no abuse of power can take place. The quantity, form, price and allocation method for these contracts will be determined by the RAs.

The RAs will implement a series of bidding principles that will set forth an expected standard of bidding behaviour but that are not unduly prescriptive and do not infringe upon the commercial prerogatives of business entities. A market monitor reporting to the RAs will be responsible for oversight of the market operations of the SEM. Adherence to bid principles will be monitored to ensure both that prices are not uncompetitively high and that incumbents cannot set prices uncompetitively low. Ring-fencing arrangements in both jurisdictions will also be reviewed to ensure that participants cannot abuse market power, which arises as a result of their position on the transmission system.

TRANSMISSION ACCESS AND NETWORK PRICING

The TSO, EirGrid, is responsible for connecting new generation plants to the transmission system. The terms and conditions of connecting to the network are subject to the approval of CER, which is also in charge of dispute settlement. Transmission tariffs are set on a national (postage stamp) basis, taking into account information related to the existing regulated asset base (RAB), operating costs (OPEX), capital expenditure costs (CAPEX) and asset values.

The CER also reviews historical data to evaluate the operators' performance over the previous control periods, and verifies the submissions for expenditure in the coming control period, including operational efficiencies, the delivery and requirements for capital investment, and improvements in the network. This task, which is technical, economic and financial in nature, may include top-down and bottom-up analyses. The TSO releases to market participants a Statement of Charges and a Tariff Schedule, detailing the prevailing tariff terms and conditions for the following year.

RETAIL MARKET

The Irish electricity retail market is currently served by eight companies of which six are independent, not being affiliated with the incumbent ESB. These are Airtricity Limited, Bord Gáis Energy Supply, Bord Gáis Éireann Cogen, CHP Supply Limited, Viridian Power & Energy Ltd (Energia), ESB Independent Energy Ltd, ESB Public Energy Supplier (ESB Customer Supply) and Waterpower Engineering Limited. Both ESB suppliers and the two Bord Gáis suppliers are owned by the Irish State. Four suppliers have a market share greater than 5%. The largest supplier, ESB PES, holds 54% of the market while its ring-fenced subsidiary holds another 16%. Since the retail electricity market was initially liberalised in 2000, the market share of independent suppliers has grown from 0% to 30% of sales.

Table 15

Market Opening Phases, 2000 to 2005

	2000	*2002*	*2004*	*2005*
Market opening by volume	28%	40%	56%	100%
Eligible volume threshold (GWh)	4	1	0.1	–
No. of eligible customers	400	1 600	13 000	1.8 million

Source: CER.

Table 16

Electricity Retail Market Shares, 2000 to 2005

Retail market share by customers in %						
	2000	*2001*	*2002*	*2003*	*2004*	*2005*
ESB affiliated suppliers	95.5%	87.4%	82.4%	76.3%	73.8%	70.3%
Non-ESB affiliated suppliers	4.5%	12.6%	17.6%	23.7%	26.2%	29.7%
Retail market share by volume in GWh						
	2000	*2001*	*2002*	*2003*	*2004*	*2005*
ESB affiliated suppliers	19 454	18 768	17 701	17 337	17 300	16 876
Non-ESB affiliated Suppliers	924	2 702	3 776	5 395	6 137	7 123
Total	**20 378**	**21 470**	**21 477**	**22 732**	**23 437**	**23 999**

Source: CER.

The CER monitors the conduct and behaviour of ESB suppliers. ESB PES, as the default supplier, must publish its tariffs, as approved by the CER. Independent suppliers, on the other hand, are not required to publish their respective tariffs. Furthermore, under regulation 18 of SI 60 of 2005, ESB PES has a duty to supply all customers who make reasonable requests for supply. Independent suppliers are not subject to this regulation. ESB's independent supply business, ESB Independent Energy (ESB IE), is licensed as a "brown", a renewable, and a CHP independent supplier. As well as being subject to generic licence conditions, ESB IE's licences contain conditions limiting its marketing activities. The present ESB IE licences also contain a market dominance condition. This condition also allows the CER to specify what constitutes the relevant market for the purpose of monitoring market dominance.

PRICES

PRICE DEVELOPMENT

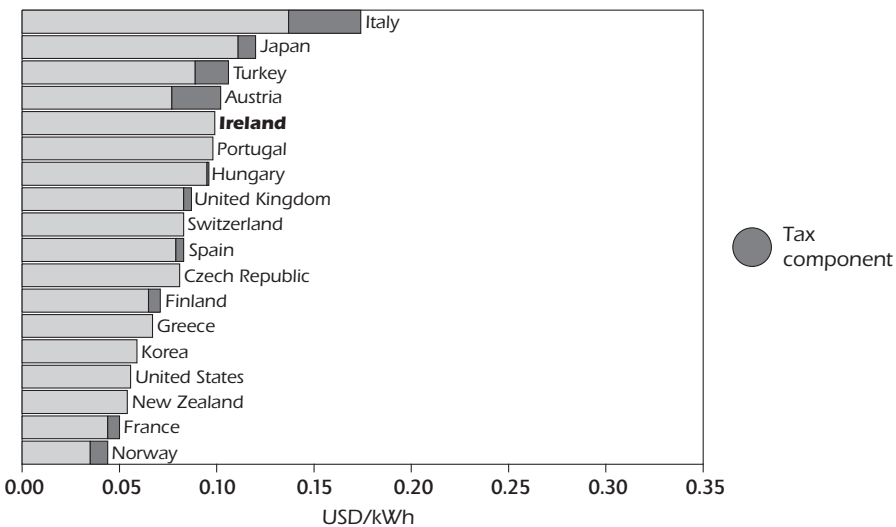
There have been significant increases in regulated electricity prices in Ireland over recent years, especially since 2004. These increases reflect sharply higher prices of gas, oil and coal, which are predominantly used in power generation in Ireland. Table 17 presents trends in ESB PES tariffs since 2001.

WHOLESALE PRICES

Contracts with a duration of one to five years cover 95% of energy traded in the form of bilateral or "over the counter" trades (either in the bilateral market or through PPAs). The CER does not have any readily available data on the volume, duration or prices of such contracts. Consequently, under the present system, there is no published information on wholesale prices. With the creation of the SEM, Ireland will have a mandatory pool in which wholesale prices will be determined through a system of bids and offers. A power pool operation will make market-based wholesale prices transparent.

Figure 16

Industrial Electricity Prices in Ireland and in Other IEA Countries, 2005



Note: Tax information not available for Korea. Price excluding tax for the United States. Data not available for Australia, Belgium, Canada, Denmark, Germany, Luxembourg, the Netherlands and Sweden.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

Table 17

Relative Tariff Changes by Tariff Class, 2001 to 2006

Tariff class	*2001*	*2002*	*2003*	*2004*	*2004 (Oct)*	*2005*	*2006*
Domestic	100	108.90	123.33	129.52	140.66	146.29	150.88
General purpose	100	103.00	106.67	110.94	120.49	122.23	127.34
Low-voltage MD	100	113.90	123.49	130.90	144.29	150.28	160.78
10-20kV MD	100	116.10	120.12	127.32	141.85	145.40	157.09
38kV MD	100	119.00	124.00	131.41	142.16	147.14	158.97
110kV MD	100	109.00	113.58	120.36	133.95	138.64	149.78
Public lighting	100	108.00	114.65	122.64	133.63	136.31	147.06
Overall	**100**	**108.60**	**119.30**	**125.37**	**136.65**	**141.44**	**147.25**
Average tariff increase in %		**8.60**	**9.85**	**5.09**	**9.00**	**3.50**	**4.11**

Source: CER.

END-USE PRICES

The CER approves the end-use tariffs of the default supplier. All other suppliers set prices below the ESB PES level. All ESB PES customers pay bundled tariffs based on pass-through generation, transmission, supply, and public service obligation costs approved annually by the CER for each of the regulated businesses. Customers connected to the distribution system also pay distribution charges. The majority of regulated ESB PES supply tariffs are formulated on the basis of characteristics of customers connected to a given network voltage level. Therefore, for the most part, tariff categorisation is not based on energy usage.

Each tariff structure comprises a two-month standing charge and a variable kWh charge. Larger customers also pay capacity charges and maximum demand charges. These tariffs are based on legacy tariff structures – changes in costs result in "top-down" adjustment of supply tariff components. These ESB PES supply tariffs are calculated annually on the basis of demand and customer forecasts and are published at the beginning of September for application from 1 January of the following year. Any deviation in these demand and customer figures is included in subsequent tariff reviews.

CRITIQUE

Significant progress has been made towards a liberalised electricity market since the last IEA in-depth review. Commendable achievements include the establishment of EirGrid as Ireland's TSO, the full market opening in February 2005, the plan to market integration with Northern Ireland through the SEM initiative and transmission expansion. These improvements are driven by a strong political will to achieve a sustainable energy future for Ireland while ensuring generation adequacy and enhancing efficiency in the power sector. Electricity consumers in Ireland will benefit from continued efforts to achieve a more competitive electricity market.

Efforts to attract new generators have improved competition in power generation. However, the generation sector remains highly concentrated since ESB still controls the majority of generating assets in Ireland, including all price-setting generating facilities, and ESB sets the price 99% of the time. This dominant position has been a key concern for current and potential market participants. Lessons from liberalised markets in IEA countries reveal that market concentration can be a key barrier for investments owing to concerns about market power, with negative impacts on pricing and project viability. It is imperative to adopt measures to enhance competition in power generation. This can be achieved by a number of approaches, including asset or output decontrol. The most straightforward is asset divestiture, which should include price-setting facilities to ensure effective competition. Creation of a SEM with Northern Ireland provides for a larger market and reduces ESB's share, but at the same time raises the concern of two dominant generators in their respective regional market. Establishment of rules for bidding and competitive behaviour is a significant step forward. Regulators should be vigilant to monitor adherence to these rules. In this context, the government should ensure that the regulator, the CER, has a clearly defined mandate and sufficient resources to properly regulate and oversee the market.

Ireland has elected to create an independent TSO to provide non-discriminatory access to the transmission system. This achievement is a major step in the right direction and is laudable. It should now consider further reforming the electricity sector by ensuring the effective separation of monopoly network assets from the competitive parts of the energy business. Since ESB still owns generation and distribution networks as well as the transmission network which is managed by the independent TSO, EirGrid, new entrants may lack transparency and assurance about the market being fully contestable. The government should therefore ensure the independence of the network operator EirGrid, to develop trust. It could consider ownership unbundling of the transmission assets as the most effective approach to create confidence in the TSO's independence and impartiality.

Current generation trends point to the risks of increasing dependence on natural gas, from about 44% of total generation currently to about 70% by 2020. Since most of the gas used for power generation is imported, more reliance on natural gas for power generation will result not only in a less diversified generating portfolio but also in higher supply risks, with potentially adverse effects on end-use electricity prices owing to high gas price volatility. Maintaining a diversified generating portfolio is essential for long-term security and reliability of electricity supply. The government's decision not to switch fuel and refurbish Moneypoint as a coal-fired power station is therefore commendable. The government and regulator should take care to ensure generation adequacy during the refurbishment period.

The moves towards market-based pricing with the creation of the SEM should be praised. This new market environment will have a system of capacity payments to ensure that investments in peak generating capacity will occur. It should be pointed out that establishing efficient market signals for investors requires that market clearing prices give adequate locational signals to direct proper siting of new generation plants. Furthermore, there is a need to allow the price to increase to levels that reflect real costs, also during times of scarcity. Price caps on wholesale prices can distort market outcomes. They have been deemed a necessary instrument to curb abuse of market power, but only under very specific supply scarcity situations. In general, price caps reduce incentives for investment in peak load resources.

Another area that should receive strategic consideration from the government is the overall efficiency of the electric power system. Improved efficiency can lead to lower electricity prices, which are among the highest in IEA Europe. The issue of low power plant availability factors should be investigated and properly addressed to avoid frequent forced outages. Twenty per cent of the current conventional portfolio (1 300 MW) will have to be replaced over the next five to seven years, owing to age and unreliability. Furthermore, transmission and distribution losses are relatively high. Development of distributed generation, such as CHP or micro-CHP, can help to reduce losses, and this should be considered by the government and regulator. A distributed generator can also add value to some power systems by delaying the need to upgrade a congested transmission or distribution network, and by providing backup power to support the local distribution network.

Because of its small size, the isolated island nature of its generation, as well as high dependence on relatively high-cost fossil-fuelled generation, electricity prices in Ireland are among the highest in IEA European countries. Consumers and industrial competitiveness have been negatively affected by an overall, cumulative electricity rate increase of close to 50% over the period 2001-2006. Given the high price situation, combined with all the changes introduced by market reforms, most consumers may not have a clear understanding of the evolving market, and may misinterpret the potential

benefits of market liberalisation. Furthermore, the general public can be more supportive to the development of renewable energy if they are better informed about the unique characteristics of the rapidly growing generation options. Better informed consumers will in all likelihood also lead to more efficient energy choices and consumption. The government should enhance public awareness, especially in areas related to electricity pricing, market reforms and renewable energy.

RECOMMENDATIONS

The government of Ireland should:

- *Actively pursue its plan to move towards the creation of a SEM and commit to clear time lines for the construction of the north-south and east-west planned transmission expansion. This should include the implementation of fully independent transmission system operations, and the consideration of creating a single independent system operator for the SEM, for whom ownership of the network asset could be considered. Carefully design market rules for the SEM, which govern capacity payments to avoid potential abuse of this measure. Price caps can distort market outcomes and should be avoided.*
- *Further enhance competition in the electricity market by reducing ESB's control of generating assets, especially price-setting generation assets.*
- *Actively promote timely and diversified investments in generating capacity to ensure generation adequacy in the medium and long term, including during the refurbishment of the Moneypoint plant. The development and creation of a state-owned landbank should be pursued. Approaches to improve plant availability and reduce network losses should be developed, taking into account the efficiency of the power generation sector.*
- *Investigate the potential for effective deployment of distributed generation, CHP and micro generation, and develop market-based incentive schemes to support growth of these applications.*

OIL

Oil is a significant contributor to Ireland's energy mix, as shown in Table 18. The share of oil in Ireland's TPES and TFC is one of the highest amongst IEA countries, and the increase in demand is primarily driven by oil use in the transport sector. Geographically isolated, and with no indigenous oil production or interconnecting pipeline infrastructure, Ireland is totally reliant on seaborne imports – crude from the North Sea (primarily the UK) for use in Ireland's only oil refinery at Whitegate, Co. Cork, with finished products not supplied through the refinery being sourced mainly from refineries on the UK west coast.

DISTRIBUTION AND MARKETING POLICIES

The oil industry in Ireland is fully privatised, liberalised and deregulated. There is free access to the market and oil companies compete on the basis of such factors as brand image, location, convenience, service, loyalty schemes and price. Post-tax gasoline prices are relatively low in Ireland, compared to other IEA countries, while diesel prices are average, but lower than those of the UK. This price divergence has led to fuel tourism across the Ireland/Northern Ireland (UK) border. Pre-tax prices for both diesel and gasoline indicate a competitive wholesale market in Ireland.

Table 18

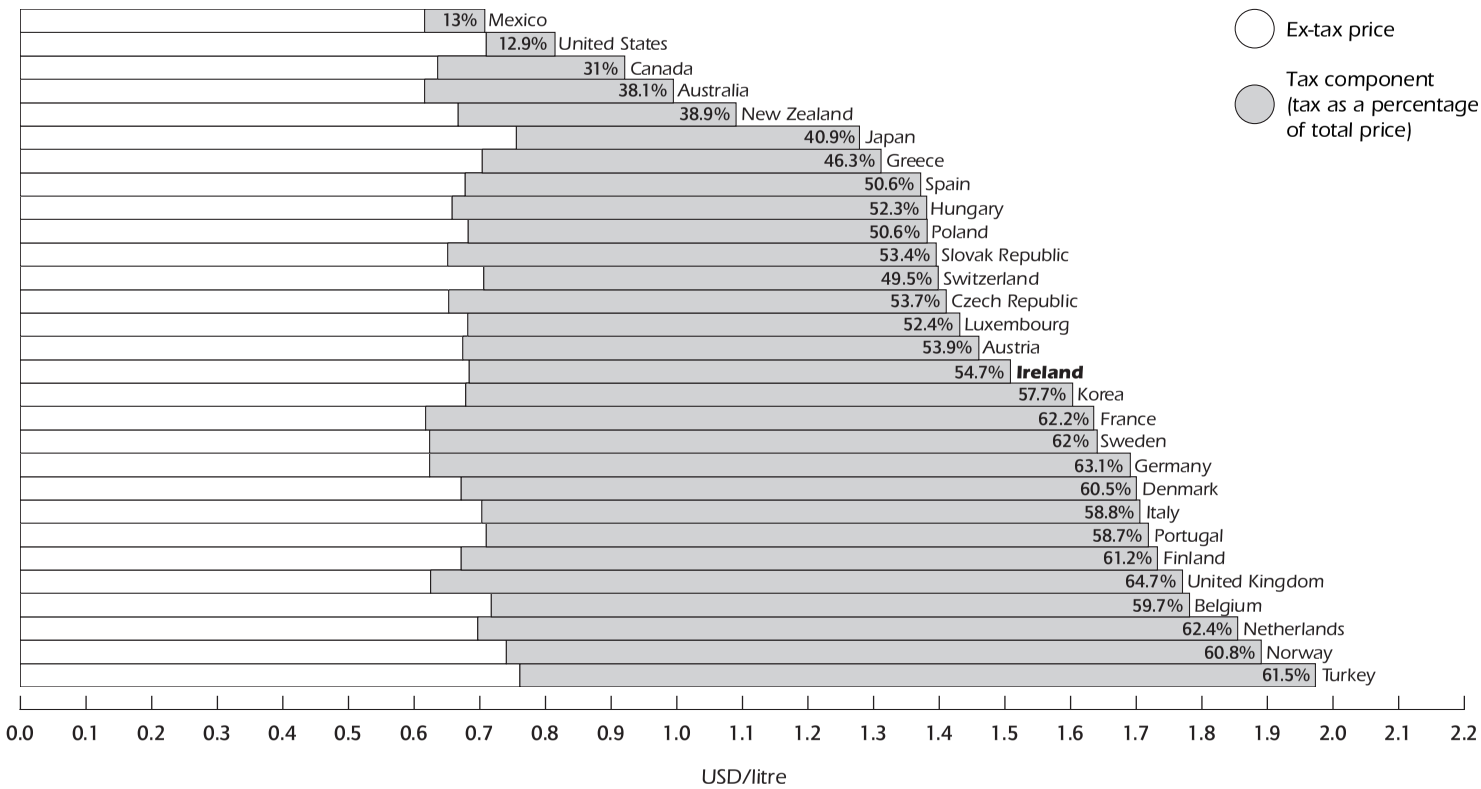
Oil in the Irish Economy, 1990 and 2005

	Mtoe		*Change*	*Share (%)*		*Change*
	1990	*2005*		*1990*	*2005*	
TPES	4.87	8.57	76%	47	56	19%
TFC	4.15	8.46	104%	52	66	27%
Power Generation	n/a	n/a	n/a	10	13.2	32%
Industry	0.88	1.37	56%	37	49	32%
Transport	2.03	5.1	151%	n/a	n/a	n/a
Other	1.24	2	61%	35	41	17%

Source: IEA.

Figure 17

OECD Unleaded Gasoline Prices and Taxes, Third Quarter 2006



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

NATURAL GAS

Since 1990, Ireland's gas consumption has risen rapidly and has undergone a significant structural shift in demand. Table 19 indicates the changes and the development. Of particular note is the significant increase in gas use in power generation, and the rapid growth of gas use in the Other Sector. To satisfy future demand, Ireland will have to continue to rely on imports from the UK, even though the projected opening of the Corrib gas field will increase the amount of national production. Figure 18 shows the requirement for capacity in the Irish system, overlaid on sources of supply.

INDUSTRY STRUCTURE

There is one gas transmission system operator (TSO) and one gas distribution system operator, the state-owned Bord Gáis Éireann (BGE). In 2004, the Commission for Energy Regulation (CER) issued transmission, distribution and supply licences to BGE. Additional legislation was introduced in late 2005 to implement further provisions of the EU's Gas Market Directive 2003/55/EC by providing for the legal unbundling of the transmission and distribution systems operations of BGE. No further unbundling is planned at the moment.

INFRASTRUCTURE

Transmission, Distribution, and Domestic Supply

The Irish gas distribution networks are owned and operated by the state-owned entity Bord Gáis Éireann (BGE). Total gas demand in the Irish market for 2004 and 2005 was 4.3 billion cubic metres (bcm) and 4.1 bcm per year respectively. In 2005, of the total gas supply of 4.1 bcm per year, indigenous production represented 0.55 bcm per year with imports comprising 3.55 bcm per year, *i.e.* 87% of gas was imported. These imports are sourced from the UK through interconnectors. In 2005, almost 60% of all gas sold was accounted for by the power generation sector. Another 25% was sold to industrial and commercial customers, while domestic customers consumed the remaining 15%.

Gas in Ireland is supplied via a network of 11 298 km of pipeline, originally developed following the gas find at Kinsale in the 1970s. The Inch entry point, located in Cork, connects the Kinsale Head and Seven Heads gas fields and the Kinsale storage facility to the onshore network. The integrated supply network consists of 2 112 km of high-pressure sub-sea and cross-country transmission pipe and 9 816 km of lower-pressure distribution pipe connecting customers to the system. The onshore transmission system has been developed over a 25-year period. The earliest part was built to supply the Cork area from the offshore Kinsale Head gas field. The connecting sub-sea pipeline is owned

Table 19

Gas in the Irish Economy, 1990 and 2005

	Mtoe		*Change*	*Share (%)*		*Change*
	1990	*2005*		*1990*	*2005*	
TPES	1.87	3.47	86%	18	23	28%
TFC	1	1.34	34%	12.8	10.4	–19%
Power generation	n/a	n/a	n/a	27.7	45.2	63%
Industry	0.79	0.43	–46%	33	16	–52%
Other	0.21	0.91	333%	6.2	18.1	192%

Source: IEA.

Table 20

Present and Future Peak Gas Demand and Supply by Use

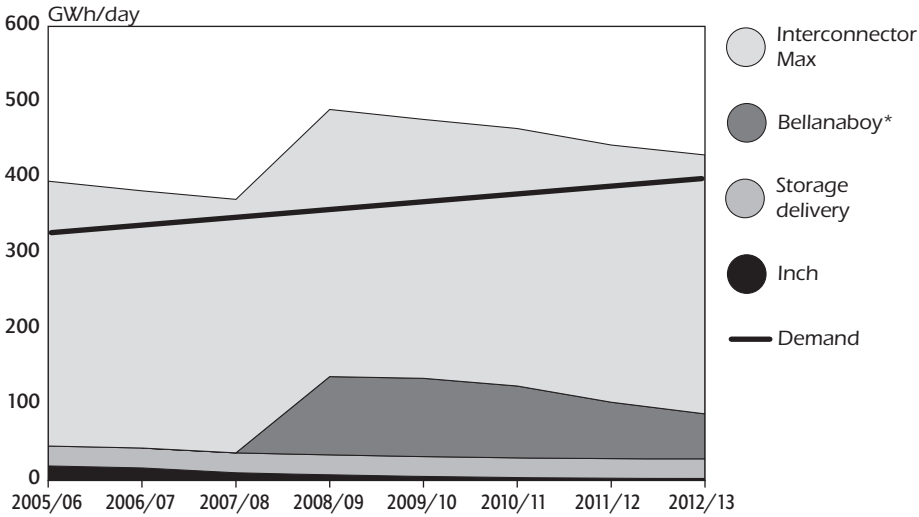
(GWh per day)

Peak demand GWh/day	*2005 /06*	*2006 /07*	*2007 /08*	*2008 /09*	*2009 /10*	*2010 /11*	*2011 /12*	*2012 /13*
Residential	68.1	73.0	77.6	81.9	86.0	90.0	94.0	98.1
I&C	57.2	59.9	62.0	64.20	66.4	69.1	70.9	72.7
Power generation	121.6	119.1	123.8	132.2	132.2	127.0	127.0	127.0
NI supplied via S/N	0.0	0.0	0.0	0.0	1.1	3.1	5.0	7.0
Shrinkage (exc. compressor use)	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.5
Peak demand in Ireland	248.2	253.3	264.7	279.8	278.1	290.6	298.5	306.3
SNIP demand	80.6	82.6	86.9	89.0	90.9	92.9	94.8	96.7
Peak supply GWh/day	*2005 /06*	*2006 /07*	*2007 /08*	*2008 /09*	*2009 /10*	*2010 /11*	*2011 /12*	*2012 /13*
Inch	19.3	16.7	10.3	7.6	5.4	3.7	2.9	2.5
Bellanaboy	0.0	0.0	0.0	103.5	103.5	95.1	74.2	59.3
Storage delivery	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1
Interconnectors	292.2	301.8	323.9	242.5	253.9	269.5	302.8	327.9
Imports	202.8	210.5	228.2	142.6	152.1	165.8	195.2	218.4
Peak supply	248.2	253.3	264.7	279.8	287.1	290.6	298.5	306.3

Source: Government submission.

Figure 18

Projected Gas Consumption vs Gas Supply, 2005 to 2013



* Bellanaboy is the location of Co. Mayo where gas from the Corrib gas field is planned to come onshore.

Source: CER.

and operated by Marathon Oil Ireland Limited. The main Cork to Dublin trunk pipeline was built by BGE in 1982, with spurs to intermediate locations. The onshore Irish system was expanded in 2002/03 by the completion by BGE of the pipeline to the west. This created a ring main pipeline system which connects eastern, western and southern regions and contributes to continuity of supply by allowing customers to be supplied from an alternative direction. The Inch entry terminal is connected directly to the Cork system and the only compressor station on the Irish onshore gas system is at Midleton, Co. Cork, to compress the gas to flow north towards Dublin.

The system is currently undergoing active development by BGE and the existing network now includes the 112 km north-west pipeline, located wholly in Northern Ireland. As part of the government's commitment to an all-island energy market, a contribution of EUR 12.7 million was provided to support the development of the 156 km south-north pipeline from Gormanstown, Co Meath (Ireland) to Ballyclare, Co Antrim (Northern Ireland, UK), where it will link in with the north-west pipeline. It was completed in 2006 by BGE at a total cost of almost GBP 97 million. The 150 km Mayo-Galway pipeline was completed in October 2006 by BGE to link the Corrib gas field to the Irish market. It will connect a proposed onshore terminal in Bellanaboy, Co Mayo to the pipeline to the west at Craughwell in Co Galway. First gas from Corrib is expected in the fourth quarter of 2009. A study is being undertaken by the

DCMNR to evaluate the possibility of bringing gas from the Galway-Mayo pipeline to Donegal town via Sligo. Also, the study will examine options for the development of gas-fired power generation along the pipeline routes.

International Connections

The BGE high-pressure transmission network is connected to the UK system through the Moffat entry point, located onshore in Scotland, which connects the Irish natural gas system to that of Transco in the UK, and allows for the importation of UK gas to Ireland via two sub-sea interconnectors. Interconnector 1 (IC1), which consists of a 600 mm pipe, has been in operation since 1993. Interconnector 2 (IC2) which consists of a 750 mm pipe was completed in 2002 and has been operational since January 2003. There is a sub-sea spur connection to the Isle of Man from IC2. The island of Ireland is also connected to Scotland through the Scotland-Northern Ireland pipeline. The Irish system has access to three compressor stations; two in south-west Scotland and one in south-east Ireland near Cork. Given that there are no capacity constraints on the Scotland-Ireland interconnectors, new entrants may secure import capacity. Since the market is a bilateral over-the-counter contracts market, no swaps market is in place. Similarly, because the market is bilateral there is no direct market surveillance.

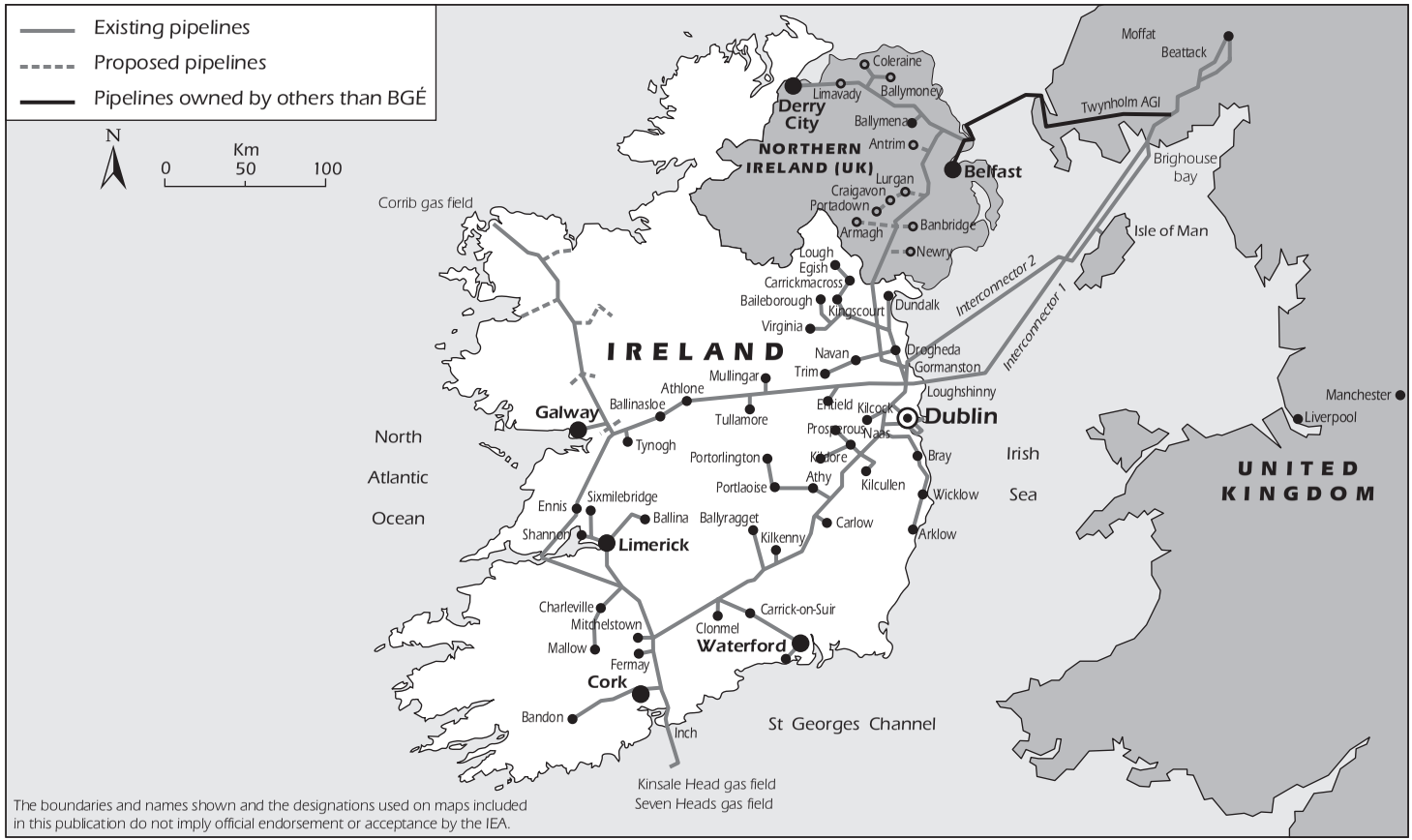
Shannon LNG, an Irish subsidiary of Hess LNG Limited, is proposing to build a EUR 400 million liquefied natural gas (LNG) receiving terminal on the Shannon estuary. The project, which is at an early stage of development, could have the potential to supply up to 40% of Ireland's gas requirements and, if approved, is expected to be completed in 2011.

Storage

Marathon Oil Ireland commenced operations of a physical gas storage facility in June 2006 using the Southwest Kinsale gas field. This facility will provide approximately 70 million cubic metres of gas with a summer time injection rate of 1.4 mcm/day and a peak withdrawal capacity of 2.5 mcm/day. Marathon has advised the CER that the ongoing viability of this facility is dependent on combined production and storage operations at the Kinsale Head field. The facility enables gas shippers to stock gas during the low summer demand period to enable withdrawal of additional winter supply at times of peak demand. Marathon is currently evaluating the feasibility of expanding this storage facility by between 30% and 40% and examining if it is feasible to operate such a facility on a stand-alone basis in the long-term (without production). Marathon has advised the CER that it may be possible to increase output from the storage facility into the transmission system on a short-term basis (days) in the event of a supply shortfall from another entry point, but this ability will decline over the winter

Figure 19

Map of the Irish Gas System



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: *Natural Gas Information*, IEA/OECD Paris, 2006.

and that cushion gas can be accessed in an emergency. Marathon has indicated that the viability of such an expansion is likely to be linked to access to the UK natural gas market.

SECURITY OF SUPPLY

The Department of Communications, Marine and Natural Resources (DCMNR) and the Department of Enterprise, Trade and Investment for Northern Ireland are currently undertaking a joint study to assess the medium- to long-term position with regard to security of natural gas supply on an all-island basis, to consider the scope for a common approach on natural gas storage and LNG. This study will be used to benchmark commercial developments against actual recommended security of supply requirements. It will also look at the question of strategic gas stocks. A range of policy actions is already planned, including the following:

- Creation of a framework for interaction between the CER and the UK TSO to identify any issues affecting the importation of gas to Ireland and the establishment of procedures to manage the impact on Ireland's gas supplies of any supply emergencies in the UK.
- Establishment of a Task Force on Emergency Procedures to ensure a co-ordinated response to supply issues affecting gas and electricity systems simultaneously and to minimise potential impacts on customers.
- Requirement for large thermal generation to be capable of generating using an alternative fuel and requiring five days on-site storage of this fuel.
- Active participation in EU Gas Co-ordination Committee and other EU and international forums.
- Legislative underpinning of security of supply mechanisms and transposition of the EU directive on security of natural gas supply is expected to be completed by mid-2007.

The CER, in carrying out its functions, must have regard for the need to secure sufficient capacity in the natural gas network system to enable reasonable expectations of demand, and to secure the continuity, security and quality of natural gas supplies. In carrying out this role, the CER produces a rolling annual Gas Capacity Statement looking forward seven years, which is a comprehensive document providing a forecast of capacity, flows and customer demand on Ireland's natural gas system over that time period (see Table 20). The CER also ensures through its licensing regime that gas market participants play an appropriate role in ensuring security of supply.

Bord Gáis Éireann (BGE), in its role as TSO and owner/operator of the interconnectors, has primary responsibility for ensuring adequacy of supply both in extreme weather and during interruption of large supply sources. The

Irish gas transmission system is designed to cope with a 1-in-50 years peak day. In common with other IEA member countries that use the same benchmark, this means that on the coldest day likely to occur once in 50 years, supply to households and small industrial and commercial customers may be uninterrupted. Load shedding for gas-fired power generators and large industrial and commercial consumers may be required. Arrangements to ensure continuity of supply for household customers are set out both in the TSO emergency plans and in the network Code of Operations. At present the emergency plans of the TSO provide for the protection of gas supplies for domestic customers. The demand management plans ensure the highest priority is given to household customers.

This position has been further strengthened by the introduction in April 2005 of a Unified Code of Operations for the transmission and distribution network. In particular, the Code provides for the protection of non-daily metered customers (including households) in that it requires shippers and suppliers of non-daily metered customers to book sufficient capacity to meet 1-in-50 peak day demand. In addition, all new gas-fired electricity generation facilities in the State are required through licence conditions to have the ability to operate for at least five days with an alternative fuel source. Transposition of EU Directive 2004/67/EC on security of natural gas is at an advanced stage and there are also additional provisions relating to emergency situations and supplier of last resort in the Energy (Miscellaneous Provisions) Act 2006.

MARKET REFORM

The Irish gas market is regulated by the CER, while the legal basis is provided by the DCMNR. Market liberalisation is proceeding on a phased basis with progressive tranches of market opening. The unbundling of BGE is at an advanced stage and is expected to be completed by the end of the second quarter of 2007 with the establishment of the Irish System Operator, a subsidiary company of BGE whose responsibilities include the operation of the BGE transportation systems in a manner consistent with the provisions of the Directive 2003/55/EC. Work is also progressing to ensure that the final requirements of the electricity and gas market directives are met by the 1 July 2007 deadline.

Work is also continuing on the development of an all-island energy market, in cooperation with the Northern Ireland authorities. With key decisions in place on the development of significant electricity interconnection (both north-south and east-west), Ireland supports further market integration to ensure that it can maximise the benefits of fully liberalised energy markets.

Table 21

Gas Market Opening Phases

	1999	*2000*	*2001*	*2002*	*2003*	*2004*
% market opening	72%	72%	77%	77%	84%	100%
Eligible volume threshold (GWh)	265	265	21	21	–	–

Source: Government submission.

Table 22

Gas Retail Market Share, 2000 to 2005

	2000	*2001*	*2002*	*2003*	*2004*	*2005*
BGS	56.5%	28.7%	38.9%	44.3%	36.9%	37%
Non-BGS affiliated suppliers	43.5%	71.3%	61.9%	55.7%	63.1%	63%

Source: Government submission.

Table 23

Gas Average End-User Prices

(in EUR/kWh)

	2005/06	*2006/07*
Residential (19 000 kWh per annum)	0.042	0.056
Mid-sized commercial (1 163 000 kWh per annum)	0.032	0.043

Source: CER.

Retail

Since 1997, the natural gas market in Ireland has been opening to competition in phases. Since 2004 all non-domestic customers have been free to choose their supplier. There are eight suppliers currently active in the Irish retail gas market. Of this number, seven are independent suppliers that are not affiliated in any way with the incumbent BGE. Total annual consumption of gas is approximately 50 000 GWh, of which over 37 000 GWh is consumed by the 19 000 customers who are eligible to choose their supplier. Of this "eligible" market, approximately 75% is served by independent suppliers. However, most of this volume is accounted for by power producers.

In 2003 the CER introduced a Regulated Tariff Formula, which is used by the incumbent to set prices for customers consuming between 5.3 GWh and 264 GWh per year. This formula is based on BGE using intercontinental exchange gas prices when providing gas for customers. By introducing a transparent formula for pricing of contracts, independent suppliers know what they have to compete against and can base their quotations on this knowledge.

By early 2006, BGE, the incumbent, supplied over 30% of Ireland's gas volume. The remaining volume was supplied by independent suppliers, or in the case of some power stations, was self-supplied. The independent suppliers competing for customers in different sectors of the gas market are Energia and Vaÿu. Flogas won the 2004 Gas Release Programme franchise.

2004 Gas Release Programme

In 2004, the CER held a competition for a Gas Supply Franchise award, which provided for the exclusive rights to supply franchise customers (within a defined geographical area newly connected to the national gas grid) with natural gas for the period leading up to full market opening. In conjunction with this competition, the CER held what may be considered a form of gas release programme, whereby the winner of the franchise was entitled to obtain gas (exclusively for the supply of the franchise business subject to the competition) from the incumbent gas company on terms and conditions (including cost) for gas which were broadly similar to those applying to the incumbent's franchise supply business. In order to facilitate this, the incumbent was directed to create a supply tariff for a new category of customer, *i.e.* the winner of the gas supply franchise. This was a one-off programme for a defined quantity of gas (limited to the amount required to supply the franchise business in the geographic area, for the duration of the franchise), made available to one entity, *i.e.* the winner of the franchise competition. The initial terms and conditions for supply of gas under the arrangements were outlined in August 2004 and revised in October 2004.

Transmission/Distribution Network

Access to the gas networks is regulated by the CER, which has been working on a programme of licensing to ensure that the incumbent supplier has been separated from the network operator. This programme is designed to raise the profile of the network operator to ensure customer awareness of the separation between network operator and BGE's supply business.

Table 24

The Irish Gas Market: Customers and Sales, 2005

	Total No. of customers	*Total vol. supplied GWh*	*Share number*	*Share volume*
Large daily metered (LDM) (>25 mcm)	13	28 225	0%	61%
Large daily metered (LDM) 5-25 mcm	25	4 420	0%	10%
Daily metered (DM) 0.5-5 mcm	173	2 365	0%	5%
Non daily metered (NDM) – small industrial and commercial customers	17 789	3 520	3.5%	8%
Non daily metered (NDM) – domestic customers	487 699	7 653	96.5%	17%
Total	**505 699**	**46 183**	**100%**	**100%**

Source: Government submission.

Transmission and distribution charges are developed by BGE and proposed to the CER as part of the annual tariff review exercise. The CER reviews the assumptions underlying these submissions and the impact these will have on system-users. The CER then carries out a public consultation on the proposed tariffs in advance of issuing a determination.

A revenue review is undertaken every four years for both transmission and distribution costs, during which the CER makes an in-depth examination of BGE's costs, including the benchmarking of costs against the same activities in other countries. BGE's allowed costs are decreased as appropriate to reflect efficiencies that should be achieved.

Natural gas market balancing arrangements are included in the Irish Gas Code of Operations, as approved by the CER. The needs of small market participants and new entrants are taken into account in the tolerance ranges, which are based on customer category (smaller customers have larger tolerances). Daily entry-exit balancing is on an aggregate basis across the entire portfolio of individual shippers, and market participants can trade out any imbalance *ex post* with another shipper, which has an opposing Daily Imbalance Quantity for the same day.

Access to storage and the tariff charged for access are negotiated.

BGE Licence Conditions

All market participants are subject to licence conditions, formulated by the CER. Some more restrictive licences apply only to BGE, recognising its position as the dominant incumbent. Conditions are:

- **Provision of information** to the CER: All gas suppliers, including BGE Supply (BGS) provide information to the CER, in such form and at such times as requested.
- **Market surveillance:** The licence also prohibits anti-competitive behaviour, stating that the licensee shall not prevent, restrict or distort competition to any appreciable extent in any market relating to the supply, distribution, transmission or storage of natural gas. The licensee is also prohibited from abusing any dominant position it may have. The CER determines whether the licensee holds a dominant position.
- **Anti-discrimination:** Condition 18 of BGE's licence prohibits discrimination in supplying or offering terms for the supply of natural gas. In particular, the licensee shall not show undue preference to any person or class of persons and shall not exercise undue discrimination between any persons or classes of persons.
- **Ban on cross-subsidisation:** Condition 16 prohibits cross-subsidisation by BGE Supply.
- **BGE's duty of supply:** Condition 19 lays down the duty to offer supply, whereby the licensee shall, upon receipt of a request from a person who the licensee is authorised to supply by the licence and who is a final customer, offer supply as soon as practicable.

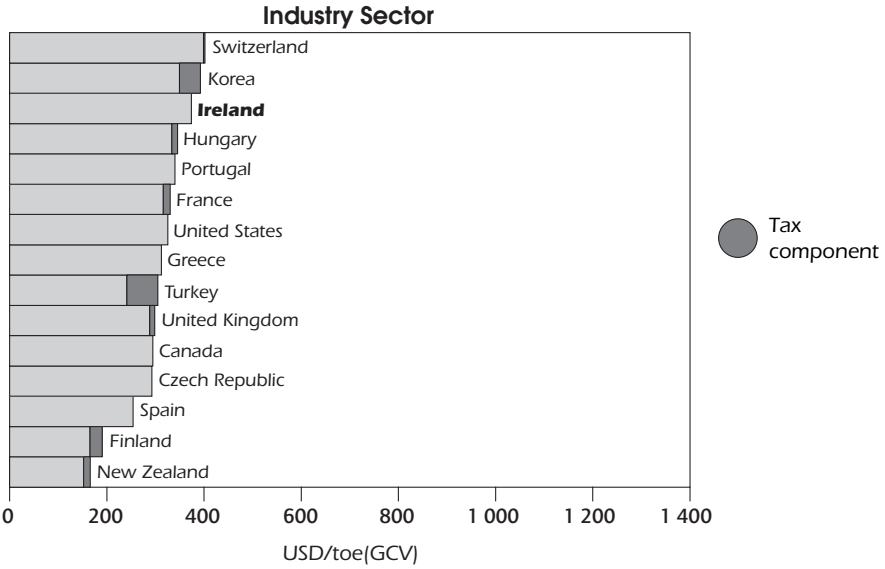
PRICE REGULATION

Regulation of charges in the natural gas market is the responsibility of the CER. This responsibility concerns the setting of BGS revenue and charges. The CER approves the tariffs of the incumbent supplier, BGS, and of the franchise holder, Flogas Natural Gas. All other suppliers have unregulated tariffs, which they tend to set at a level just below that of BGE. The Irish gas supply market consists of the following major categories:

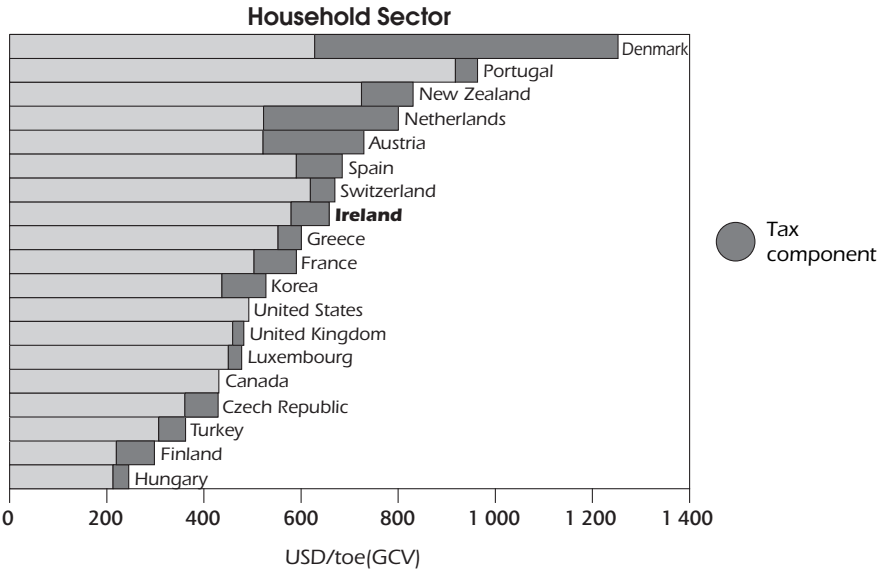
- Current eligible market.
- Large end-user market (over 264 GWh per year).
- Gas-fired power generation market.
- Regulated tariff formula market (5.3 GWh – 264 GWh).
- Market for customers paying industrial and commercial tariffs (up to 5.3 GWh).
- Non-eligible market.
- Domestic customers.

Figure 20

Gas Prices in IEA Countries, 2005



Note: Tax information not available for the United States. Data not available for Australia, Austria, Belgium, Denmark, Germany, Italy, Japan, Luxembourg, the Netherlands, Norway and Sweden.



Note: Tax information not available for the United States. Data not available for Australia, Belgium, Germany, Italy, Japan, Norway and Sweden.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

BGS gas supply tariffs to final customers are segregated into two categories. The revenue control formula is applied to customers with a consumption level of less than 5.3 GWh per year, while the regulated tariff formula (RTF) is applied to customers with a consumption level of between 5.3 GWh and 264 GWh per year at a single supply point. However, gas customers within the 5.3 to 264 GWh per year consumption level that use gas to produce electricity, including CHP, have the choice between a RTF tariff and an "unregulated" tariff. At present the retail tariff is divided, on average, into gas procurement costs (63%), network costs (32%) and supply margin (5%).

EXPLORATION AND PRODUCTION

Ireland currently produces small amounts of gas and no oil. In 1996, Irish gas fields supplied over 80% of the Irish market. This position is now reversed with more than 85% of Ireland's gas supply being met by imports via the interconnectors from Scotland. Since the 1970s Ireland has been supplied from the Kinsale and Ballycotton fields delivering to the Inch terminal near Cork. These fields are now in decline. The addition of gas production from the Seven Heads field (also off the Cork coast) from December 2003 has contributed to the indigenous supply, albeit at significantly lower rates than originally projected. A future source of supply is the Corrib gas field currently being developed off the west coast of Mayo.

There is no direct state involvement in oil and gas exploration. The objective of government policy is to maximise the benefits to the State from exploration for and production of indigenous oil and gas resources, while ensuring that activities are conducted safely with due regard to their impact on the environment and other land/sea users. Since 1992, Ireland has had a comprehensive regime of fiscal and non-fiscal measures applicable to hydrocarbon exploration, development and production. Petroleum exploration and production policy is pursued under the 1992 Licensing Terms for Offshore Oil and Gas Exploration and Development, under which private enterprise is licensed to conduct exploration and production under terms and conditions that balance the interests of the State with private enterprise, while ensuring the following:

- Effective and efficient exploration and production.
- Operations are carried out in accordance with best practices.
- Effective liaison with the exploration and production industry.

The current fiscal terms are contained in the 1992 Finance Act as amended by the 1999 Finance Act. Corporation tax at 25% applies where production of oil and gas takes place under a petroleum lease granted by the Irish authorities.

One hundred per cent allowances are available for exploration, development and operating expenses with a provision for the allowance of unsuccessful exploration expenditure for 25 years. A "Ring Fence" provision operates around oil and gas exploration and production so as to prevent the tax yield for non-petroleum activities being reduced by the offset of the high cost of petroleum development. There is also provision for an allowance for expenditure on the abandonment of fields and dismantling of pipelines to shore. There is no provision for royalty payments or state participation in the current Licensing Terms. In the case of the Kinsale and Ballycotton gas fields, production is carried out under an earlier agreement and a royalty of 12.5% applies, since they predate the 1992 licence regime.

Given the recent increases in energy prices, the Minister for Communications, Marine and Natural Resources has initiated a review of the present licensing terms, both fiscal and non-fiscal. The review will take into account recent increases in energy prices and other factors, particularly the improved understanding of Ireland's potential as a petroleum province. The review is expected to be completed early in 2007, with the objective that any adjustments to the licensing terms will apply to the new licensing round in 2007.

In 2006, four wells were completed in the Irish offshore province: two appraisal/development wells and two exploration wells. Two wells have been drilled in the Celtic Sea (one exploration and one development/appraisal), and one in the Donegal Basin (exploration). Seismic surveys taken in 2006 covered 2 067 km two-dimensial and 856 sq km three-dimensional. Two licensing rounds have been held by the government in 2005/06: the North East Rockall Round in 2005 over 65 full blocks and 12 part blocks, and the Slyne/Erris/Donegal Round in 2006 over 73 full blocks and 31 part blocks. In total there are 13 offshore and two onshore exploration licences currently in force. Five licences were issued in 2005 and a further four in 2006. It is expected that a further licensing round will be held in 2007.

The Corrib Gas Development

The Corrib field is a gas development in the Atlantic Ocean, situated off the coast of Ireland. It is approximately 40 miles west of the Erris peninsula in County Mayo and lies in the Slyne Trough in Blocks 18/20 and 18/25. The Corrib gas field was discovered in 1996 by Enterprise Oil, and acquired by Shell Partners in 2002. It is the first commercial find offshore Ireland since Kinsale Head in 1973. The Corrib equity owners are as follows:

- Shell E&P Ireland (operator) 45%
- Statoil Exploration (Ireland) Limited 36.5%
- Marathon International Petroleum Hibernia Limited 18.5%

The water depth in the area is 1 150 ft and the gas reservoir is located 11 500 ft to 13 000 ft below the seabed. When developed, the hydrocarbons will be produced over a period ranging from 15 to 20 years.

The project has been delayed by controversy over the siting of onshore installations, in particular a pipeline. In April 2001 an initial planning application for the gas terminal was submitted to Mayo County Council. In October 2004, An Bord Pleanála granted planning permission for the Bellanaboy gas terminal. By the end of the year, an earthworks contractor had been mobilised at the Bellanaboy terminal site, paving the way for bringing the gas ashore and guaranteeing security of supply for the country for many years to come. In August 2005, while offshore works continued, Shell announced a temporary suspension of work on the onshore section of the pipeline in order to facilitate further discussion with parties opposed to the development. The DCMNR appointed Advantica Ltd. (a UK engineering consultancy firm) to carry out an independent safety review of the onshore section of the gas pipeline to address the issue of safety, and subsequently, announced that a formal mediation process was to be set up to address concerns relating to the Corrib project. In May 2006, the final report of the independent safety review on the onshore section of the Corrib pipeline was published and found no significant safety concerns. Work commenced on the terminal site on 3 October 2006. The developer is endeavouring to re-route the onshore pipeline and first gas is expected in late 2009.

EMERGENCY PREPAREDNESS

Ireland's oil stock policy has evolved in response to its international commitments arising from its membership of the European Union (EU) and of the International Energy Agency (IEA). Originally the maintenance of Ireland's reserves lay with the oil industry operating in Ireland, but in 1995, the National Oil Reserves Agency (NORA) was established. NORA is responsible for maintenance of oil stocks at a level determined – at least once a year – by the relevant minister. In this regard, NORA acts as the agent of the relevant minister. Oil importers and large oil consumers are no longer obliged to hold strategic stocks but are expected to hold a prudent level of operating stocks, which are included in Ireland's emergency reserve calculation. The establishment of NORA has helped to give a stronger focus to national stockholding arrangements during a period when Ireland has experienced significant growth in oil demand. The National Oil Reserves Agency Act 2007 was recently enacted, creating a statutory footing for NORA. In absolute terms, stockholding arrangements have been satisfactory in the recent past as is apparent from Table 25.

Table 25

Average Annual National Oil Stocks - IEA Calculation (days)

2002	2003	2004	2005	2006	2007 (1 Feb)
116	112	108	108	121	115

Source: Country submission.

Since 2002, emergency response policy-making functions in relation to oil have been vested in the Minister for Communications, Marine and Natural Resources. NORA operates as Ireland's National Emergency Sharing Organisation (NESO). This division works in close co-operation with both the oil industry and NORA on emergency planning and during periods of physical disruptions to oil supplies. A part of the stocks is held abroad.

The Handbook on Oil Supply Disruption Contingency Measures, which was finalised in 2007, provides officials working in the field of emergency preparedness with the fundamental elements of the national oil crises response policies, including legislative and organisational information. In addition, a range of emergency test scenarios have been agreed with NORA and the oil industry with a view to initiating tripartite test exercises on an annual basis from 2007 onwards.

COAL AND PEAT

COAL

Ireland is not producing any coal. Coal has had a diminishing share of the Irish industrial and residential market in recent years. While overall consumption has grown in absolute terms, this has largely been the result of increased electricity demand. Since its purchase of Coal Distributors Ltd. (CDL), Bord na Móna has become the largest importer to the residential domestic market. Imports come largely from the USA, Poland and the UK. The main user of coal in Ireland is the Electricity Supply Board (ESB) at its coal-fired electricity-generating plant at Moneypoint. The ESB imports its own coal supplies from a variety of producer countries such as the USA and Colombia.

Fuel allowances are payable during the winter months to low-income households to assist with home-heating costs. These subsidies apply to all types of fuels. Because of the increased cost of smokeless coal products, a supplementary allowance is payable to those who use such products in the designated smoke-free areas.

PEAT

Indigenous peat remains a core element of Ireland's energy mix in the interests of security of supply and the use of indigenous energy sources. 370 MW of electricity is available from three new peat-fired plants in

Edenderry (120 MW), now owned by Bord na Móna, and the ESB-owned Lanesboro (100 MW) and Shannonbridge (150 MW) plants. Edenderry was commissioned in 2000 and the two new ESB plants in 2005. These plants have an efficiency rate of 37% compared to the 26% efficiency rate of the old plants, which have now been decommissioned.

The use of peat in electricity generation continues to be supported by a Public Service Obligation (PSO) Order. This provides for the recoupment by ESB of the additional costs incurred by comparison with the costs of a best new entrant. Bord na Móna, the state-owned peat company, produces about 4 million tonnes of milled peat per year, most of which is used as feedstock for electricity generation. The level of the PSO is set annually by the Commission for Energy Regulation (CER) and can be zero in any given year.

Bord na Móna

In view of the declining and finite nature of its core peat businesses, Bord na Móna sought, and obtained, approval from the Minister for Communications, Marine and Natural Resources to develop future strategy proposals in order to ensure the future viability and sustainability of the company. These strategy proposals include investment in existing peat power plant generation with a view to co-fuelling with biomass. Edenderry Power Ltd[13], in association with Bord na Móna, has carried out tests on the feasibility of co-fuelling the Edenderry plant with biomass to prolong its life expectancy. In 2002 approximately 3 000 tonnes of wood biomass was procured by Bord na Móna and delivered to Edenderry Power Ltd. as part of a small co-fuelling trial which lasted for a period of six days. Over 90% of the biomass material was sawdust with the remainder being wood chip, both of which were mixed with peat in varying proportions using the normal fuel handling equipment before being delivered to the boiler for combustion. In this initial trial, no fuel-handling difficulties of any significance were observed, and there was no noticeable impact on the combustion process. This provided a positive indication of the technical feasibility of co-fuelling this type of material with peat. Edenderry Power Ltd received conditional planning permission in February 2005 for a material change of use of the electricity generating station, from that of a power station for the generation of electricity from the combustion of peat, to use as a power station and a waste recovery facility for the generation of electrical power from the combustion of a mix of fuels, including biomass in the form of wood material and recovered meat and bone meal. This successful application is part of plans to reduce CO_2 emissions.

13. Before it was bought by Board na Móna.

CRITIQUE

OIL

Oil dependence in Ireland's energy consumption stands at around 56% of TPES in 2005 (47% in 1990). It is currently expected to decrease only marginally. The security of oil supply deserves particular attention of the government to ensure continuous availability of oil in the country. More importantly, the government should consider urgent measures to effectively reduce this very high dependence. One commendable step has already been taken: while oil is still contributing significant amounts to electricity generation today (13% in 2005), the Irish government assumes that this will fall to 0% by 2010, because of the closure of obsolescent power stations using oil, and their replacement with gas-fired power and renewables. Much stronger action than this is needed, however, to address oil demand growth in the transport sector, and the government should consider taking urgent action to reduce Ireland's dependence on oil by developing alternative fuels, reducing congestion, and promoting modal shifts. It is commendable that the government intends to commission a study to review the security of Ireland's access to oil.

EMERGENCY PREPAREDNESS

The National Oil Reserves Agency (NORA) has oil storage in several places in Ireland. However, to meet its storage demands, Ireland also has bilateral oil stockholding agreements with France, Belgium, Sweden, the Netherlands, the UK and Denmark. These agreements reflect the 1998 amendments to the relevant EU directive on oil stocks. The 2006 Green Paper recommends holding a greater proportion of owned stocks within the country, and this is a laudable development. It is also commendable that legislation to establish NORA as an independent agency under the aegis of the Minister for Communications, Marine and Natural Resources was recently enacted.

Ireland participated in the joint action following hurricane Katrina in 2005. The government should be praised for its contribution to the IEA emergency action.

NATURAL GAS

The incumbent Bord Gais Éireann (BGE) is responsible for all activities in the delivery chain of gas to Ireland, and supplies almost 100% of Irish customers, even though its market share in supply by volume is significantly lower, because of some large-volume customers procuring gas from other suppliers or directly from the wholesale market. BGE owns and operates the gas networks.

In 2004, the CER issued transmission, distribution and supply licences to BGE. Large commercial customers can opt to procure and import their supply requirements directly through purchase in the UK, and import through the interconnector. A segment of medium-sized customers is open to competition under a regulated tariff formula (RTF), which allows new entrants to compete with BGE by establishing a reasonably high tariff under which BGE has to supply these customers.

The total number of gas customers in Ireland stands at approximately 506 000 and is growing rapidly. The gas market is currently only competitive for commercial customers. At present, the market is 86% liberalised by volume, with three independent suppliers. It is expected to be fully open in 2007. For these customers, gas is imported mainly from the liquid and competitive British gas market. The market for households and smaller businesses is rather small in volume and not yet open to competition. An independent supplier holds the franchise to supply five towns along the western gas pipeline. This franchise will end with market opening in 2007.

Given Ireland's reliance on imports, it is likely that its gas market will remain heavily influenced by the British market and the scope for competition will remain reasonably positive as a result, especially for large commercial customers. However, given the small size of the market, successful competition will require the removal of all possible regulatory obstacles to new entrants, otherwise they are unlikely to invest. This crucially depends on the implementation of distribution system operator unbundling, which is required from 2007 in the Republic of Ireland (but not necessarily in Northern Ireland given that the directive's exemption has been applied there).

BGE has a number of advantages over potential new entrants given its control of the connection business, and its access to lower-cost gas and storage from the Kinsale field. Government ownership also leads to a lower level of risk for BGE's activities, compared to new, private, entrants. The government should consider putting an obligation on the connections business to act in a neutral manner in recommending suppliers, and it should consider constraining BGE from procuring gas from the Corrib field once it comes on stream. A certain portion of this gas should be reserved for new entrant suppliers in the residential and small commercial markets. The CER should consider obliging BGE to offer a flexible storage product that will allow new entrants access to storage in order to enable them to balance their supplies.

Ireland has a robust infrastructure both for transportation and distribution of gas but lacks sufficient storage capacity. The Mayo-Galway pipeline, which is necessary for the transportation of gas from the Corrib gas field, has been built, and the new south-north pipeline links with the north-west pipeline located in Northern Ireland (UK). In terms of international interconnections,

Ireland has two pipelines connecting its network with Great Britain, and these interconnections are sufficient for future demands.

Owing to the recent decline in production of the existing natural gas fields, indigenous fields currently contribute less than 15% of gas, and the demand for natural gas, especially in the power generation sector, will expand rapidly. A stable and secure supply of natural gas at competitive prices is of crucial importance for Ireland. The island has no operational indigenous source of natural gas after the projected depletion of the Kinsale gas field, which is already operating at end-of-life levels. To diversify gas supply, the opening of the Corrib gas field is a priority and should be supported by the government. The construction of an LNG terminal has been proposed by a private operator and this could contribute to increase the security of supply and achieve diversification in supply sources.

EXPLORATION AND PRODUCTION

Many players in the petroleum industry see Ireland as a relatively underexplored petroleum region with limited potential for commercially exploitable finds. This is reflected in the comparatively low interest in licensing rounds, but it is possible that this perception is now changing. The government has made a commendable effort to increase the information about the potential of the Irish petroleum province, and to encourage exploration activities. Coupled with recent high oil prices, this activity may lead to a renewed interest in on- and offshore oil and gas exploration.

Nevertheless, it is clear that more needs to be done to encourage exploration in the Irish petroleum province, to reduce the risk for operators. Particular barriers include the absence of a petroleum services industry in Ireland, the challenging geological and climatic conditions, the relative lack of knowledge about the potential owing to a lack of seismic research and the fiscal regime. The government should consider learning from best practice in other countries, such as Norway, on how to attract petroleum companies to become active in Ireland. Most importantly, the government may have to consider the development of a fiscal regime that encourages exploration. Any change to the current regime should favour increasing exploration activity.

PEAT AND COAL

Peat and coal play a unique role in Ireland's energy mix. Both contribute to security of supply by diversifying the energy sources; however, special consideration is necessary to mitigate GHG emissions. All coal used in Ireland is imported. All peat is domestically produced and consumed, and peat-firing in power stations is supported by a public service obligation (PSO) for the

recovery of capital costs of the three new peat-fired power stations. Peat is currently the cheapest fossil fuel for power generation in Ireland.

The decision to modernise the peat-fired generation plant has had tremendous emissions and efficiency benefits. It has also given the government an opportunity to introduce large-scale biomass co-firing for electricity generation in Ireland. Bord na Móna's diversification strategy to produce electricity from other primary energy besides peat is commendable.

The use of coal in electricity generation will remain in the foreseeable future, following the decision to prolong the life of the Moneypoint power station without switching it to gas. Moneypoint can continue to operate on coal until approximately 2020, by which time the station will be 35 years old. To ensure continued diversity of supply, the government should begin to consider the impact of a potential replacement of the current Moneypoint station by a clean coal station with full carbon capture and storage (CCS) should this become an economical alternative.

RECOMMENDATIONS

The government of Ireland should:

Oil

- *Implement a holistic long-term strategy to reduce Ireland's oil dependence from its present high levels, taking into account measures such as increases in excise tax, fuel-switching, use of biofuels and efficiency.*

Emergency Preparedness

- *Quickly pass and implement the proposed legislation to establish NORA as a state agency, and continue to pursue an increase in the share of oil stocks held in Ireland.*

Natural Gas

- *Create an investment-friendly, transparent environment in the natural gas market and consider, on an all-island basis, taking into account projected demand increases, the potential of natural gas storage and an LNG terminal for enhancing the country's security of supply.*
- *Enable new entrants in the gas market to access all assets in the gas system on an equal basis with BGE.*

Exploration and Production

- *Develop a framework that encourages exploration and the introduction of new companies into the Irish petroleum industry by implementing best practice from abroad. In particular, ensure that the fiscal regime for exploration and production adequately reflects the industry's risks and perception of the Irish petroleum province.*
- *Promote public acceptance in the local areas affected by fossil-fuel developments and streamline the legal procedures by identifying benefits for the possible participants.*
- *Undertake a thorough analysis of the potential of the Irish petroleum province, including resource mapping, making this information available to potential investors.*
- *Speed up the opening of the Corrib gas field to obtain an indigenous source of natural gas, taking into account environmental considerations.*

Peat and Coal

- *Continue the development of biomass co-firing at peat-fired power stations and the use of peat in power generation, taking into account environmental considerations and the role of peat as an indigenous fuel.*

TECHNOLOGY AND RESEARCH & DEVELOPMENT

OVERVIEW

The goals of the government's energy research and development (R&D) programme are to develop high-quality, co-ordinated, focused, long-term R&D activities, which are well aligned with energy and wider policy objectives. Energy research activities are undertaken in support of national energy policy objectives, which are concerned with the maintenance of secure energy supplies to support economic growth and competitiveness, while ensuring that energy supply and use is environmentally sustainable.

The government's Science, Technology and Innovation Strategy covering the period from 2006 to 2013 was published in June 2006. Government committed a significant level of funding to science, technology and innovation in the Strategy, with the cost estimated at approximately EUR 3.8 billion over the lifetime of the Strategy. This development represents a significant change in the funding allocated over the period 1997 to date, which saw funding treble in this area. Total government Strategy-related investment is stated to be in excess of EUR 2.7 billion for the period up to 2008. The Strategy therefore maintains the trend of increasing significantly the allocation of public resources to Irish R&D. Energy R&D is a key element of the Strategy. The new National Development Plan (NDP) addresses energy R&D activities and programmes in more concrete terms.

In the past, energy R&D investment was focused where results could be expected in the short-term. In line with changes to the national approach to science and technology formulated in relation to enterprise policy, a more strategic medium- to long-term view is being developed, and the effective and efficient co-ordination of R&D activities is receiving higher attention than before to ensure that energy R&D supports national energy, environmental and/or economic policy objectives.

DCMNR undertook a strategic review of energy R&D activity and prepared an inventory of projects active in 2003, together with a review of institutional capabilities. The review also analysed the capacity for energy R&D within the relevant institutions in Ireland, based on published information and in-house knowledge, both in DCMNR and the Department of Enterprise, Trade and Investment, Northern Ireland. In the context of increasing co-operation on energy matters between the government administrations in Ireland north and south, account was taken of known relevant research activity in Northern Ireland.

There were a number of important qualifications to the inventory approach DCMNR took in its review of energy R&D activity:

- Only those institutions with an assumed activity were polled for information.
- Some organisations known to be active did not submit returns, despite reminders.
- The data submitted were not verified.
- "Private" funding may have been overstated, owing to inappropriate allocation by respondents.
- It did not give a clear picture of capacity to undertake energy research work on a continuing basis.

In giving a view of the research activity and skills existing at the time of the review, the exercise was sufficient to draw conclusions and arrive at priorities for action:

- A key feature was that energy research centres in Ireland are very small, and frequently weak, normally comprising only a few key people of whom only a subset are on long-term or permanent contracts.
- Research activity has tended to be project-based, and together with the stop-start nature of support, is not conducive to developing and supporting national energy research capacity.
- Sustainable Energy Ireland (SEI) programmes were found to play a key role in sustainable energy research, by helping to create expertise, utilising existing capacity. They have also provided some means of enhancing capacity through the acquisition of additional personnel or equipment.
- Multi-disciplinary projects are becoming more prevalent than in the past, reflecting increasing co-operation and the growing complexity of the R&D challenges.
- Common skills exist North and South and there are some relevant links between research teams in both jurisdictions.

Although some work on energy economics and socio-economic work related to energy was reported, work on non-technical energy R&D could have been under-reported. As work on emissions trading, energy taxes and the use of fiscal instruments to promote technological options becomes more important, the government is coming to the view that there is no logic in maintaining a separation between technology-focused and economics-related R&D.

In 2004, a more structured approach towards establishing the scope and character of energy research and related activities was adopted. Following the

review of energy R&D activity, DCMNR published policy proposals for mechanisms to improve energy research co-ordination and alignment of energy R&D with national energy and other policies, and then engaged in a consultation exercise with interested parties. The policy being adopted is to use a light-handed approach to better co-ordinate and focus the existing apparatus for energy research, and has led to the establishment of a new non-statutory Irish Energy Research Council.

The government's 2006 energy policy Green Paper reiterated the need to enhance the strategic direction for Irish energy research in the national energy infrastructure. In this context, it set out priority areas for the medium term: addressing energy efficiency, demand management and renewable energy technologies, furthering all-island initiatives in energy research to build on existing co-operation and building energy research capacity in the higher education system. This latter issue has been identified for early action with the creation of the Charles Parsons Awards to accelerate the development of energy research capacity.

The Charles Parsons Awards

Developing the national energy research capacity is a key priority for the Irish government to ensure that appropriately skilled people are available to meet energy research needs. The approach taken was to design and implement a scheme of funding awards for energy research projects and researchers.

The Charles Parsons Awards were developed specifically to accelerate the build-up of research capacity, in line with the key importance with which the government views the energy area. This initiative is also closely aligned with the government plan to double the output of PhDs by 2013, which is a key objective of the Science, Technology and Innovation Strategy.

Following a call for applications for funding in October 2006, 22 applications were received from 11 organisations located both North and South. The applications were evaluated using a panel of international experts located outside Ireland. The funding awards were announced in December 2006, providing a total of EUR 20 million in funding for a total of 208 researchers and students over the period of the Awards.

This expansion of Irish energy research capacity will provide vital knowledge and skilled individuals that are so important to the

development of Irish energy-related industry. The Awards will significantly increase Irish energy research capacity by providing funding to the tertiary education institutions. This helps them to build sustainable research teams comprising senior researchers, PhD studentships and undergraduate summer placements. International mobile researchers should be attracted to Ireland as a result. The scheme will also raise the awareness of Ireland as a good location to carry out research, an important step in the attraction of energy related investments.

The Awards have been granted to:

- National University of Ireland Galway, Microbial Bioenergy Group,
- Queen's University Belfast, Electrical Power and Energy System Research Cluster,
- University College Cork, Hydraulics and Maritime Research Centre,
- University College Dublin, Bioresources Research Centre,
- University College Dublin, Electricity Research Centre,
- University of Limerick, Charles Parson Research Institute & Graduate School,
- University of Ulster, Centre for Sustainable Technologies.

INSTITUTIONS

DCMNR is responsible for formulating overall energy research policy, ensuring co-ordination and enhancing appropriate national capacity in the energy R&D area. It also aims to facilitate access to resources from relevant EU programmes and other external sources in support of Irish energy R&D.

An important role in co-ordinating energy R&D in Ireland is now played by the Irish Energy Research Council, which is a newly formed institution created following the review of energy R&D activity in Ireland in 2004. It has the remit to:

- Establish priorities for energy research.
- Co-ordinate all existing energy RD&D activities in Ireland.
- Develop and promote a policy for energy research.
- Facilitate co-ordination of energy research policy with wider energy, innovation, enterprise and education and training policies.

- Take a leading role in linkages with appropriate international bodies, such as the EU and the IEA, and in formulating the Irish engagement with the energy elements of programmes, such as the EU's Seventh Framework Programme for Research.
- Undertake such underpinning analysis as required to inform policy development and strategic direction of relevant national RD&D programmes.
- Directly support major strategic initiatives which cannot currently be supported by existing players and mechanisms.

SEI plays a significant role in sustainable energy research policy implementation. SEI manages sustainable energy research programmes, channels funding and accesses EU funding in this area. SEI's programmes are to:

- Assist deployment of new, appropriate technologies.
- Raise awareness and provide information on best practice.
- Fund R&D projects.
- Stimulate preparation of necessary codes and standards.
- Publish statistics and projections on sustainable energy.

SEI offers contracts for research work through advertised calls for proposals within defined programmes. SEI programmes can support capital investment costs, but only where these are directly project-related. Project-related costs and overhead for general R&D infrastructure cannot be supported by SEI.

One of the CER responsibilities is to encourage R&D in renewable, sustainable and alternative forms of energy. To date, the CER has developed several limited initiatives to address this, and further activities are under consideration.

A number of other agencies and entities also conduct energy-related research. These include public-sector bodies such as Teagasc, the Environmental Protection Agency, the Marine Institute and Enterprise Ireland, and also in the area of relevant technical research, with the Economic and Social Research Institute (ESRI) conducting research relevant to economic policy. The ESRI has conducted policy research in the energy sector since its foundation and established an Energy Policy Research Centre in 1990 to produce relevant energy research "with the aim of informing policy-making and societal understanding". It currently undertakes work on energy demand forecasting, climate change and electricity markets. ESB/ESB Networks, Bord na Móna, Airtricity, Viridian and others undertake and/or support energy-related research pertaining to their businesses.

FUNDING

Ireland spent a total of EUR 94.6 million[14] on government energy R&D between 1974 and 2002. Of this, 31.5% was allocated to renewable energy projects. Government energy R&D expenditure peaked in 1981 and declined notably after 1983. There was no attempt to identify funding specifically dedicated to energy R&D between 1992 and 2002, even though limited amounts of government funding were available. In 1991 (in 2003 prices) the total expenditure was EUR 6.9 million, of which 73% was provided from state funds and 23% from EU programmes.

A separate survey of expenditure on energy R&D was carried out in 1999. It found that the total expenditure in 1999 (in 2003 prices) was almost EUR 2 million, spread over 60 projects with an average budget of EUR 33 000 each. Of this, 36% was provided from public funds, either on a project basis or as part of a block grant. Most of the remaining 64% was provided from EU programmes, with only a very small contribution from the private sector.

During the 1980s there was strong alignment between national and EU programmes. Work supported by government or business funds was often able to access EU funding. This provided useful gearing for limited national programmes.

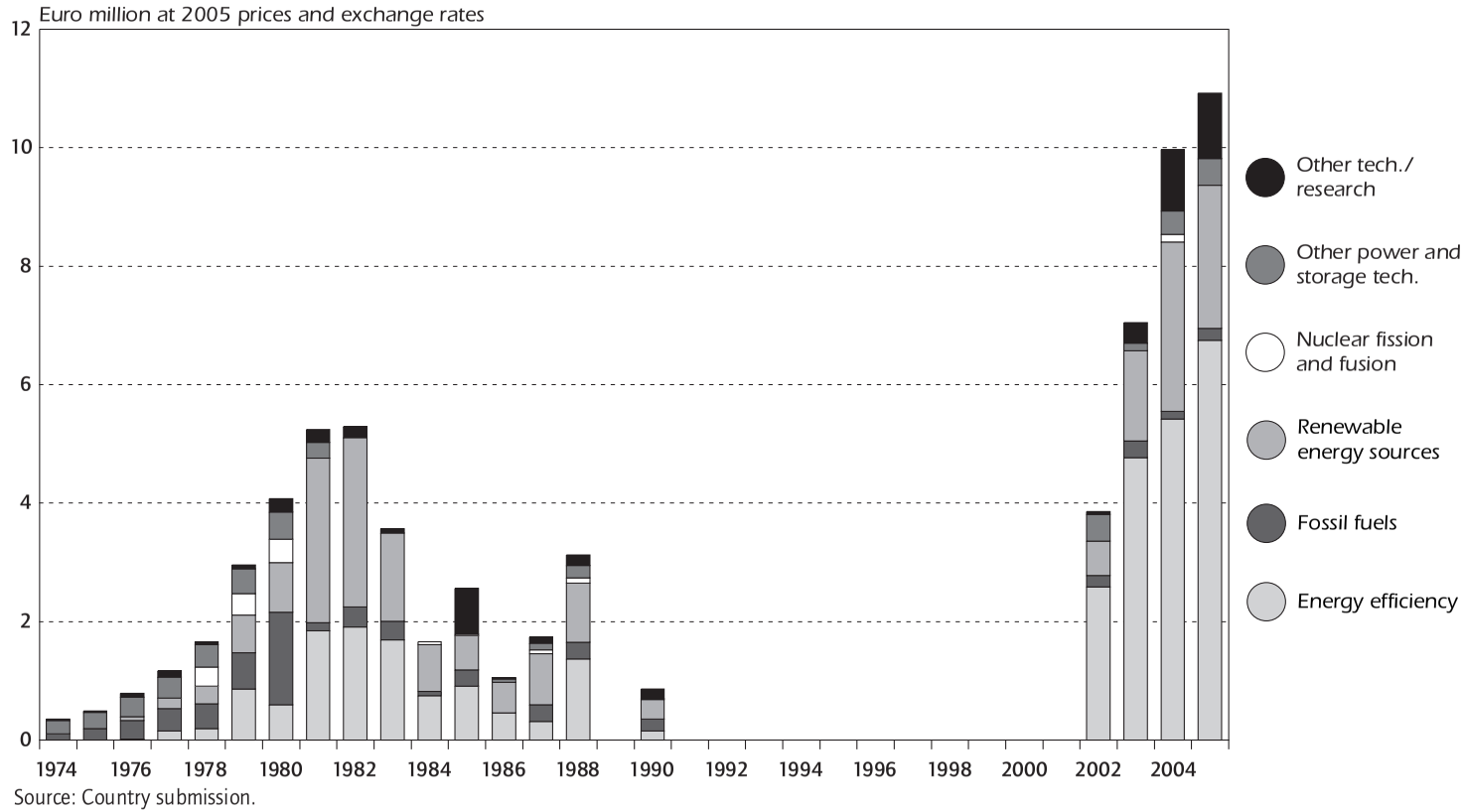
According to the 2004 review of energy R&D activities mentioned above, the volume of energy R&D carried out in 2003 reached EUR 7.1 million, spread over 81 projects in 50 organisations. The scale of projects varied from EUR 5 000 to EUR 1.1 million, with the average project expenditure being EUR 88 000. Approximately 23% of this sum was provided from public funds, either on a project basis or as part of a block grant. Most of the remaining 77% was provided from private funding, including internal sources of the institutions carrying out the activity and EU programmes. Of the 81 projects, 30 were part-funded by the EU with no government funding, 46 were supported by government funds but not by the EU, and five received funding from both EU and government sources.

Renewables received the largest portion of government (60%) and EU (39%) funds (see Figure 22). Most activity in this area was in wind and biomass, but there was also significant work on wave, photovoltaic and geothermal energy. Substantial work was also reported on energy applications for buildings and some on transport, while there were also many projects

14. In 2002 prices and exchange rates.

Figure 21

Government Energy R&D Budget, 1974 to 2005

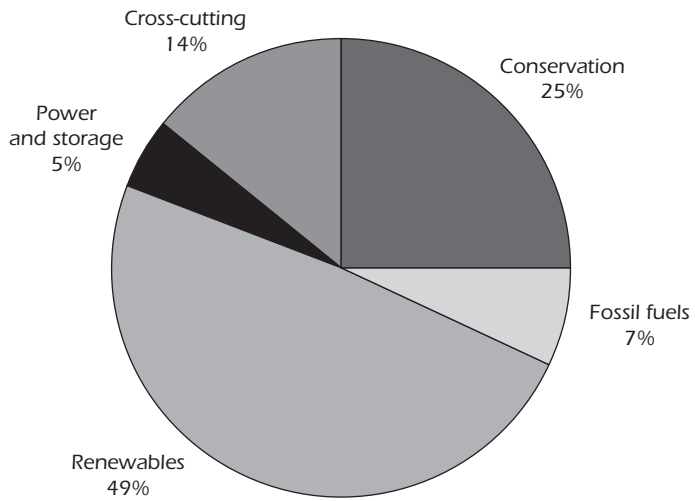


Source: Country submission.

concerned with system integration issues. For the first time since such inventories were compiled, no work was reported on energy conservation in industry. One energy economics project and one socio-economic project were reported.

Figure 22

EU and State Support for Energy R&D by Sector, 2004



Source: Country submission.

In terms of development since 1999, total government funding has increased substantially, although it has not reached 1991 levels, and EU funding has increased marginally. However, in an important structural shift, "private" or "own funds" have become the most significant source of funding, accounting for 51%. The new government budget line for 2006 of EUR 3.5 million is set to increase over the period of the NDP and the Science Strategy to support energy research initiatives. This will complement other funding opportunities, including the potential for energy capacity building through Science Foundation Ireland.

MAJOR PROGRAMMES

Ireland has a wide range of R&D activities in its institutions. Table 26, based on the 2004 review, gives an overview of activities by institution and centre.

Table 26

Ireland's Energy RD&D Capacity by Institution

Institution	*Research unit*	*Subject area*
Republic of Ireland		
University College Cork	Hydraulics & Marine Research Centre	Wave energy
	Sustainable Energy Research Group	Wind energy modelling
		Energy storage
		Fuel cells
		Energy policy
University College Dublin	Energy Research Group	Energy use in buildings
		Passive solar
	Dept of Planning and Environmental Policy	Energy economics
	Energy Conversion Research Centre	Refrigeration/heat pumps
	Electricity Research Centre	Wind energy
		Power system dynamics
		Electricity market structures
University College Galway	Department of Chemistry	Combustion chemistry
University of Limerick	Wave Energy Research Team	Wave energy
NUI Maynooth	Department of Electronic Engineering	Electrical load forecasting
		Wave energy device control
Trinity College Dublin	Dept of Mechanical and Manufacturing Engineering	Heat exchangers
	Dept of Civil, Structural & Environmental Engineering	Eco-transport
Dublin City University	Dept of Mechanical and Manufacturing Engineering	Heat transfer
Dundalk Institute of Technology	Centre for Renewable Energy	Wind energy
		Biomass
		Energy policy/economics

Table 26

Ireland's Energy RD&D Capacity by Institution *(continued)*

Institution	*Research unit*	*Subject area*
Cork Institute of Technology	Department of Engineering	Fuel cell control
Tipperary Institute of Technology	Sustainable Rural Development Departmentt	Biomass
Sligo Institute of Technology	Department of Civil Engineering	Energy use in buildings
ESRI	Energy Policy Research Centre	Energy economics
		Energy forecasting
		Energy markets
Northern Ireland		
Queen's University Belfast	Electric Power and Energy Systems	Control of power systems
		Power systems engineering
		Energy systems engineering
		Machine design and control
	Hydraulics Research Group	Wave energy
	School of Mechanical Engineering	Internal combustion engines
University of Ulster	Northern Ireland Centre for Energy Research and Technology/Centre for Sustainable Technologies	Refrigeration/heat pumps
		Energy use in buildings
		Photovoltaic systems
		Combustion technology
		Synthetic fuels
		CO_2 capture technologies
Department of Agriculture and Rural Development	Horticulture and Plant Breeding Station	Biomass

Source: Government submission.

The Irish Ocean Energy Strategy 2006

The government intends to implement an ocean energy strategy to advance the speed at which ocean energy technologies are deployed in Ireland by increasing the capacity for R&D, both within academic institutions and commercial entities developing devices in Ireland. It views a structured and phased strategy of development support as the best way to enable Ireland to utilise its ocean energy resource by 2015. In addition to providing another clean indigenous source of energy to Ireland, success in building the capability to use the ocean energy resource could provide a new market for energy project developers, and potentially an export market for those designing or producing ocean energy devices.

The ocean energy resource available to Ireland indicates a potential to supply between 50% and 60% of the forecast all-island electricity demand from wave and 6% from tidal energy sources within 100 km of the shoreline; however, it is not yet known how much of this could be exploited economically. Ireland has research expertise in the areas of turbine design at University of Limerick, wave tank model testing at the Hydraulics and Maritime Research Centre of University College Cork, and wave energy modelling at Queen's University. In terms of prototype development, there are currently three wave energy developers in Ireland, namely Ocean Energy, Hydam and Wavebob. These activities represent the early stages of a potential new industry in Ireland. To date, national agencies have provided an estimated EUR 1.2 million in grant-aid to this sector, but a more sustained long-term commitment is required to enable ocean energy to contribute to energy demand in the next decade. A four-phase strategy to capitalise on Ireland's ocean energy resource is proposed with review procedures and decision gates at the end of each phase:

Phase 1 (2005 to 2007)

This phase focuses on development by supporting product R&D and research facilities. The objective of this phase is to develop and test large-scale prototype concepts and develop technical leadership in this area. The estimated grant support cost for Phase 1 is EUR 4.9 million. Following a review of Phase 1, a decision to proceed to Phase 2 will be taken.

Phase 2 (2008 to 2010)

This phase would support the development of pre-commercial grid-connected devices with the objective of demonstrating the potential for a cost-effective, fully functional wave energy converter operating in the Irish electricity market. An option to support either a national developer or an external commercial developer is included. Grant-support for product development and a test connection along with electricity price support could be offered. The estimated cost for Phase 2 is

EUR 10.5 million. Following a review of Phase 2, a decision to proceed to Phase 3 will be taken.

Phase 3 (2011 to 2015)

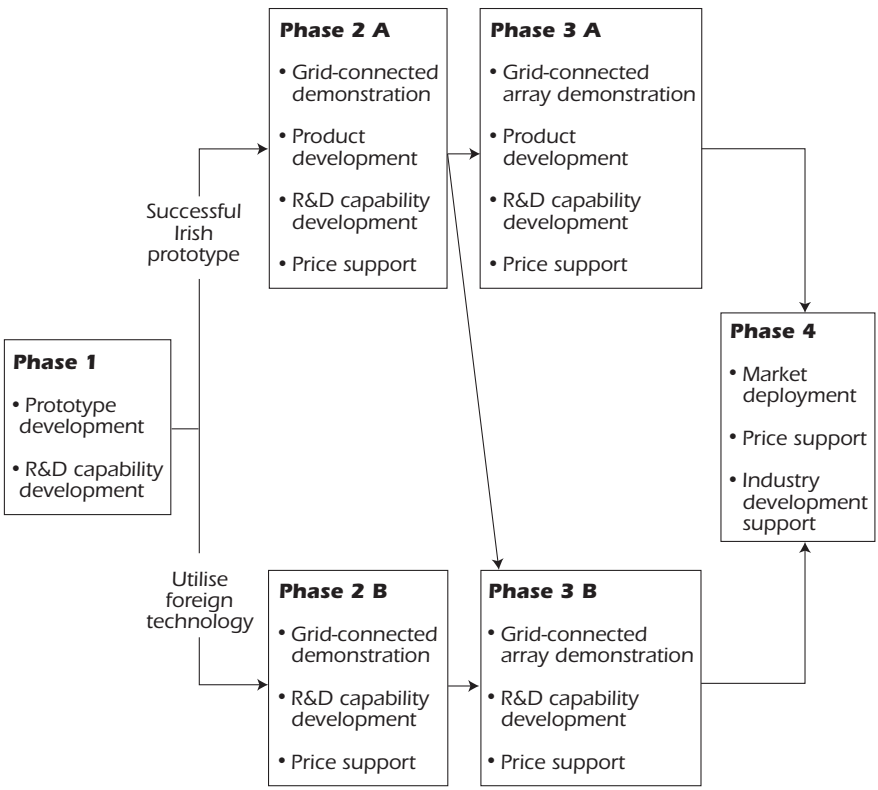
This phase could provide support for a 10 MW large-scale array of devices to be connected to the grid. Some level of grant support for product development and grid connection, and electricity price support, would likely be required. Following a review of Phase 3, a decision to proceed to Phase 4 will be taken.

Phase 4 (2016 onwards)

Large-scale market deployment for ocean energy. It is likely that some level of industry development support will be necessary at this phase; particularly if an export-focused industry in manufacturing ocean energy devices is to be developed.

Figure 23

The Ocean Energy Strategy Concept, 2005



Source: *Ocean Energy in Ireland,* SEI/DCMNR, 2005.

CRITIQUE

Compared to other EU nations, Ireland has a lower focus on energy R&D, owing to the size of its market and the absence of major domestic energy companies. Historically, government funding for energy R&D has been limited, and as a consequence, energy R&D was project-based, capabilities were time-limited by funding constraints, and fragmentation was high.

In 2004, the government undertook a strategic review of energy R&D capabilities, which led to important findings regarding the state of energy R&D in Ireland. The undertaking of such a review, to provide the basis for a long-term strategic approach, is highly commendable. It will now need to be followed by regular monitoring and evaluation in order to avoid a situation where no knowledge about energy R&D investment and capacity exists, which was the case in the 1990s.

Importantly, the overview of Ireland's capacity for undertaking R&D does not include very significant activity in the commercial semi-government bodies, such as the ESB and Bord na Móna in the Republic of Ireland and the private-sector Viridian Group in Northern Ireland. For example, Bord na Móna carried out energy R&D with a budget of EUR 617 000 in 2003, and it is probable that there are other substantial programmes which are not reported. Given fragmentation and limited funds, there should be a strong national co-ordination function to ensure appropriate adoption of the R&D results. For example, capacity data from Northern Ireland suggests that some complementarities exist, which could be developed on an all-island basis, where cross-border funding should be available, and this could become a means to support energy R&D infrastructure in the longer term. This would leverage the country's limited investment to the maximum extent possible.

To complement improved in-country co-ordination, Ireland should expand its efforts to look beyond the country's borders to benefit from the best available energy R&D expertise. Although Ireland is already a participant in a few international energy collaborative efforts, such as the IEA Bioenergy Implementing Agreement, perhaps more knowledge could be gained in other key technology areas that are of interest through expanded participation in IEA Implementing Agreements or other collaborative networks.

Continuity of work and developing appropriate national capacity is very vulnerable to the absence of consistent funding over a number of years, such as happened between 1991 and 2002. In this respect, the continuity afforded by the NDP should already have improved the situation in the period from 2004 to 2006, and DCMNR should work to ensure that designated NDP programmes, activities and funding in energy R&D are delivered. An indication of the risk of disappearing expertise could be gained by a study of projects covering the period 2004-2006.

More disconcertingly, some of the energy R&D work is not currently particularly well-aligned with national policy. It appears to be stand-alone in nature, related particularly to the capability of the establishment and/or source of funds available, and therefore highly vulnerable. Some national excellence exists, primarily thanks to EU support mechanisms, but this is not co-ordinated with national requirements. Therefore, although national co-ordination and focus on meeting policy objectives have improved since the time of the previous IEA review, more needs to be done in this area to ensure consistency of government strategy and research activity.

The existing energy R&D support mechanisms in Ireland do not easily provide for activities involving significant new human or capital infrastructure. Unlike in the areas of biotechnology or information and communication technology R&D, there are few sustained support mechanisms to attract and retain key skills in the energy area. It will be a key challenge for DCMNR to develop such a long-term approach.

The establishment of the Irish Research Council is a welcome development and should be commended, as is the development of Sustainable Energy Ireland (SEI) as an institution and funding body for sustainable energy research. SEI funding can give clear focus to research activities in the sustainable energy sector, and in particular could help emerging technologies to bridge the "Valley of Death", between the laboratory and market deployment, to achieve market deployment. For example, in recent years, specific challenges and opportunities have emerged with regard to renewable energy that give Ireland an opportunity to develop R&D capabilities and knowledge in fields where good international co-operation and exploitation potential exist. The rapid growth of wind on the isolated Irish electricity system puts Ireland at the forefront of experience with the integration of wind generation into electricity networks and the development of storage solutions. At the same time, the particular nature of the renewables resource and settlement patterns present a unique opportunity for the development of micro-scale distributed wind generation technologies and biomass heating. Also, the potential for marine power technologies is high. These are examples of R&D areas in which Ireland could develop focused capabilities. The development of an Ocean Energy Strategy is therefore very laudable.

RECOMMENDATIONS

The government of Ireland should:

- *In consultation with the Irish Research Council, consider further developing programmes and activities that support energy R&D focusing on Irish needs.*
- *Strengthen monitoring and evaluation of energy R&D activities.*

- *Continue to enhance national co-ordination of energy R&D activities to leverage several isolated stand-alone centres and projects into a consistent whole.*
- *Consider the development of energy R&D and market introduction capabilities and pathways focused on network integration of wind and the development of micro-generation technologies.*
- *Expand its participation in international energy R&D collaborative efforts, including in IEA Implementing Agreements, to take advantage of expertise outside Ireland.*
- *Continue to increase energy R&D efforts to develop ocean energy. Strong potential for joint international work exists in this area.*

ORGANISATION OF THE REVIEW

REVIEW CRITERIA

The *Shared Goals* of the IEA, which were adopted by the IEA ministers at their 4 June 1993 meeting held in Paris, provide the evaluation criteria for the in-depth reviews conducted by the Agency. The *Shared Goals* are set out in Annex C.

REVIEW TEAM

The In-Depth Review Team visited Dublin from 6 to 10 November 2006. During the visit, the team met with government administrators, energy suppliers and various other organisations and interest groups, and addressed the major issues relating to the Irish energy situation.

The team is grateful for the co-operation and assistance of the many people it met during its visit. Thanks to their willingness to share information and open hospitality, the visit was both highly productive and enjoyable. The team wishes to make special mention of the understanding and courteous professionalism displayed by everyone in the Energy Team of the Department of Communications, Marine and Natural Resources, in preparing and accompanying the visit.

The members of the team were:

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Czech Republic

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Federal Ministry
of the Economy, Belgium

Jean Lamy
Ministry of Industry, France

Giordano Rigon
European Commission

François Nguyen
International Energy Agency

Hisashi Yoshikawa
International Energy Agency

Andreas Biermann
International Energy Agency

Andreas Biermann managed the review and drafted the report with the exception of the electricity chapter which was drafted by François Nguyen. Monica Petit and Bertrand Sadin prepared the figures. Sandra Martin provided editorial assistance.

ORGANISATIONS VISITED

Airtricity

Aughinish Alumina

Bord Gáis Éireann

Bord na Móna

Commission for Energy Regulation

Competition Authority

Consumer Association of Ireland

Department of Communications, Marine and Natural Resources

Department of Environment and Local Government

Department of Finance

Department of Transport

Economic and Social Research Institute

EirGrid

Electricity Supply Board

Enterprise Ireland

Flogas

Forfás

Industrial Development Agency

Irish Business and Employers Council

Irish Wind Energy Association

Irish Renewable Energy Association

Marathon Ireland

National Consumer Council

National Oil Reserves Agency

Offshore Operators Association

Shell Ireland

Sustainable Energy Ireland

Viridian

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2004	2005	2010	2020	2030
TOTAL PRODUCTION		**1.120**	**3.467**	**1.888**	**1.662**	**3.156**	**3.908**	..
Coal[1]		0.045	0.016	–	–	–	–	..
Peat		1.020	1.411	0.890	0.810	0.835	0.567	..
Oil		–	–	–	–	–	–	..
Gas		–	1.872	0.688	0.461	1.840	2.703	..
Comb. Renewables & Waste[2]		–	0.108	0.199	0.241	0.288	0.284	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.055	0.060	0.054	0.054	0.070	0.070	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	0.057	0.096	0.123	0.284	..
TOTAL NET IMPORTS[3]		**5.901**	**7.101**	**13.848**	**13.691**	**15.350**	**17.844**	..
Coal[1]	Exports	0.073	0.024	0.018	0.019	–	–	..
	Imports	0.578	2.033	1.938	1.987	2.268	0.930	..
	Net Imports	0.505	2.009	1.920	1.968	2.268	0.930	..
Peat	Exports	–	–	–	–	–	–	..
	Imports	–	–	–	–	–	–	..
	Net Imports	–	–	–	–	–	–	..
Oil	Exports	0.472	0.680	1.301	1.438	–	–	..
	Imports	5.956	5.788	10.286	10.082	9.454	11.647	..
	Bunkers	0.092	0.018	0.152	0.106	–	–	..
	Net Imports	5.392	5.090	8.833	8.538	9.454	11.647	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	–	–	2.959	3.009	3.493	5.132	..
	Net Imports	–	–	2.959	3.009	3.493	5.132	..
Electricity	Exports	0.002	–	–	–	–	–	..
	Imports	0.006	–	0.135	0.176	0.135	0.135	..
	Net Imports	0.004	–	0.135	0.176	0.135	0.135	..
TOTAL STOCK CHANGES		**0.168**	**-0.202**	**-0.585**	**-0.064**	**–**	**–**	..
TOTAL SUPPLY (TPES)		**7.189**	**10.365**	**15.151**	**15.289**	**18.506**	**21.752**	..
Coal[1]		0.565	2.105	1.880	1.928	2.268	0.930	..
Peat		1.020	1.349	0.361	0.760	0.835	0.567	..
Oil		5.545	4.871	8.820	8.565	9.454	11.647	..
Gas		–	1.872	3.644	3.469	5.333	7.835	..
Comb. Renewables & Waste[2]		–	0.108	0.199	0.241	0.288	0.284	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.055	0.060	0.054	0.054	0.070	0.070	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	0.057	0.096	0.123	0.284	..
Electricity Trade[4]		0.004	–	0.135	0.176	0.135	0.135	..
Shares (%)								
Coal		*7.9*	*20.3*	*12.4*	*12.6*	*12.3*	*4.3*	..
Peat		*14.2*	*13.0*	*2.4*	*5.0*	*4.5*	*2.6*	..
Oil		*77.1*	*47.0*	*58.2*	*56.0*	*51.1*	*53.5*	..
Gas		*–*	*18.1*	*24.1*	*22.7*	*28.8*	*36.0*	..
Comb. Renewables & Waste		*–*	*1.0*	*1.3*	*1.6*	*1.6*	*1.3*	..
Nuclear		*–*	*–*	*–*	*–*	*–*	*–*	..
Hydro		*0.8*	*0.6*	*0.4*	*0.4*	*0.4*	*0.3*	..
Geothermal		*–*	*–*	*–*	*–*	*–*	*–*	..
Solar/Wind/Other		*–*	*–*	*0.4*	*0.6*	*0.7*	*1.3*	..
Electricity Trade		*0.1*	*–*	*0.9*	*1.2*	*0.7*	*0.6*	..

0 is negligible. – is nil, .. is not available

All forecasts are based on the 2005 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2004	2005	2010	2020	2030
TFC	**5.416**	**7.992**	**12.125**	**12.807**	**14.590**	**17.961**	..
Coal[1]	0.520	1.146	0.490	0.521	0.433	0.274	..
Peat	0.408	0.570	0.177	0.183	0.181	0.123	..
Oil	3.856	4.150	7.975	8.460	9.322	11.516	..
Gas	0.103	0.998	1.324	1.337	1.933	2.662	..
Comb. Renewables & Waste[2]	–	0.108	0.175	0.211	0.187	0.181	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.529	1.021	1.983	2.094	2.534	3.205	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*9.6*	*14.3*	*4.0*	*4.1*	*3.0*	*1.5*	..
Peat	*7.5*	*7.1*	*1.5*	*1.4*	*1.2*	*0.7*	..
Oil	*71.2*	*51.9*	*65.8*	*66.1*	*63.9*	*64.1*	..
Gas	*1.9*	*12.5*	*10.9*	*10.4*	*13.2*	*14.8*	..
Comb. Renewables & Waste	–	*1.4*	*1.4*	*1.6*	*1.3*	*1.0*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*9.8*	*12.8*	*16.4*	*16.4*	*17.4*	*17.8*	..
Heat	–	–	–	–	–	–	..
TOTAL INDUSTRY[5]	**1.920**	**2.371**	**2.632**	**2.785**	**2.499**	**3.129**	..
Coal[1]	0.044	0.256	0.148	0.164	0.225	0.166	..
Peat	–	–	–	–	–	–	..
Oil	1.662	0.880	1.330	1.371	0.866	1.282	..
Gas	0.025	0.787	0.433	0.427	0.561	0.721	..
Comb. Renewables & Waste[2]	–	0.063	0.129	0.163	0.146	0.146	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.189	0.386	0.592	0.660	0.701	0.814	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*2.3*	*10.8*	*5.6*	*5.9*	*9.0*	*5.3*	..
Peat	–	–	–	–	–	–	..
Oil	*86.6*	*37.1*	*50.5*	*49.2*	*34.7*	*41.0*	..
Gas	*1.3*	*33.2*	*16.5*	*15.3*	*22.4*	*23.0*	..
Comb. Renewables & Waste	–	*2.7*	*4.9*	*5.9*	*5.8*	*4.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*9.8*	*16.3*	*22.5*	*23.7*	*28.1*	*26.0*	..
Heat	–	–	–	–	–	–	..
TRANSPORT	**1.406**	**2.031**	**4.709**	**5.101**	**6.278**	**7.605**	..
TOTAL OTHER SECTORS[6]	**2.090**	**3.589**	**4.783**	**4.921**	**5.813**	**7.227**	..
Coal[1]	0.476	0.890	0.342	0.357	0.208	0.108	..
Peat	0.408	0.570	0.177	0.183	0.181	0.123	..
Oil	0.788	1.240	1.941	1.995	2.191	2.642	..
Gas	0.078	0.211	0.891	0.910	1.372	1.941	..
Comb. Renewables & Waste[2]	–	0.045	0.046	0.047	0.041	0.035	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.340	0.634	1.386	1.429	1.820	2.378	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*22.8*	*24.8*	*7.2*	*7.3*	*3.6*	*1.5*	..
Peat	*19.5*	*15.9*	*3.7*	*3.7*	*3.1*	*1.7*	..
Oil	*37.7*	*34.6*	*40.6*	*40.5*	*37.7*	*36.6*	..
Gas	*3.7*	*5.9*	*18.6*	*18.5*	*23.6*	*26.9*	..
Comb. Renewables & Waste	–	*1.3*	*1.0*	*1.0*	*0.7*	*0.5*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.3*	*17.7*	*29.0*	*29.0*	*31.3*	*32.9*	..
Heat	–	–	–	–	–	–	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2004	2005	2010	2020	2030
ELECTRICITY GENERATION[7]							
INPUT (Mtoe)	**1.766**	**3.120**	**4.839**	**4.920**	**6.103**	**6.637**	**..**
OUTPUT (Mtoe)	**0.632**	**1.224**	**2.168**	**2.204**	**2.790**	**3.507**	**..**
(TWh gross)	7.348	14.229	25.215	25.626	32.447	40.776	..
Output shares (%)							
Coal	*1.0*	*41.6*	*24.7*	*24.9*	*20.4*	*6.1*	..
Peat	*23.9*	*15.8*	*5.9*	*9.6*	*7.4*	*4.0*	..
Oil	*66.3*	*10.0*	*12.7*	*13.0*	*0.0*	*0.0*	..
Gas	*–*	*27.7*	*51.1*	*45.2*	*64.1*	*78.9*	..
Comb. Renewables & Waste	*–*	*–*	*0.4*	*0.5*	*1.1*	*0.9*	..
Nuclear	*–*	*–*	*–*	*–*	*–*	*–*	..
Hydro	*8.8*	*4.9*	*2.5*	*2.5*	*2.5*	*2.0*	..
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	..
Solar/Wind/Other	*–*	*–*	*2.6*	*4.3*	*4.4*	*8.1*	..
TOTAL LOSSES	**1.649**	**2.354**	**3.401**	**3.574**	**3.916**	**3.791**	**..**
of which:							
Electricity and Heat Generation[8]	1.134	1.896	2.671	2.716	3.420	3.242	..
Other Transformation	0.329	0.146	0.197	0.268	–	–	..
Own Use and Losses[9]	0.186	0.312	0.533	0.590	0.496	0.549	..
Statistical Differences	**0.12**	**0.02**	**–0.38**	**–1.09**	**–**	**–**	**..**

INDICATORS

	1973	1990	2004	2005	2010	2020	2030
GDP (billion 2000 USD)	24.60	48.34	117.61	124.11	154.66	207.85	..
Population (millions)	3.07	3.51	4.06	4.15	4.17	4.51	..
TPES/GDP[10]	0.29	0.21	0.13	0.12	0.12	0.10	..
Energy Production/TPES	0.16	0.33	0.12	0.11	0.17	0.18	..
Per Capita TPES[11]	2.34	2.96	3.73	3.68	4.44	4.83	..
Oil Supply/GDP10	0.23	0.10	0.07	0.07	0.06	0.06	..
TFC/GDP[10]	0.22	0.17	0.10	0.10	0.09	0.09	..
Per Capita TFC[11]	1.76	2.28	2.99	3.09	3.50	3.99	..
Energy-related CO_2 Emissions (Mt CO_2)[12]	21.0	30.2	41.4	–	–	–	..
CO_2 Emissions from Bunkers (Mt CO_2)	1.1	1.1	2.6	–	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–04	04–05	05–10	10–20	20–30
TPES	3.6	1.4	2.7	0.9	3.9	1.6	–
Coal	6.9	8.7	–0.8	2.6	3.3	–8.5	–
Peat	2.1	1.4	–9.0	110.5	1.9	–3.8	–
Oil	2.3	–2.4	4.3	–2.9	2.0	2.1	–
Gas	–	13.6	4.9	–4.8	9.0	3.9	–
Comb. Renewables & Waste	–	–	4.5	21.1	3.6	–0.1	–
Nuclear	–	–	–	–	–	–	–
Hydro	4.3	–1.5	–0.7	–	5.3	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	68.4	5.1	8.7	–
TFC	4.3	1.2	3.0	5.6	2.6	2.1	–
Electricity Consumption	5.8	2.9	4.9	5.6	3.9	2.4	–
Energy Production	4.6	8.1	–4.2	–12.0	13.7	2.2	–
Net Oil Imports	2.9	–2.0	4.0	–3.3	2.1	2.1	–
GDP	4.9	3.6	6.6	5.5	4.5	3.0	–
Growth in the TPES/GDP Ratio	–1.3	–2.1	–3.6	–4.4	–0.6	–1.3	–
Growth in the TFC/GDP Ratio	–0.6	–2.2	–3.3	0.1	–1.8	–0.9	–

Please note: Rounding may cause totals to differ from the sum of the elements.

FOOTNOTES TO ENERGY BALANCES AND KEY STATISTICAL DATA

1. Coal includes lignite and peat, except for Finland, Ireland and Sweden. In these three cases, peat is shown separately.

2. Combustible renewables and waste comprises solid biomass and biogas. Data are often based on partial surveys and may not be comparable between countries.

3. Total net imports include combustible renewables and waste, and trade of heat.

4. Total supply of electricity represents net trade. A negative number in the share of TPES indicates that exports are greater than imports.

5. Industry includes non-energy use.

6. Other Sectors includes residential, commercial, public service, agricultural, fishing and other non-specified sectors.

7. Inputs to electricity generation include inputs to electricity and CHP plants. Output refers only to electricity generation.

8. Losses arising in the production of electricity and heat at main activity producer utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 100% for hydro.

9. Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.

10. Toe per thousand US dollars at 2000 prices and exchange rates.

11. Toe per person.

12. "Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2005 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The 26 member countries* of the International Energy Agency (IEA) seek to create conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and to the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives, member countries therefore aim to create a policy framework consistent with the following goals:

1. **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2. Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3. **The environmentally sustainable provision and use of energy** are central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should respect the Polluter Pays Principle where practicable.

4. **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA member

* Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

countries wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5. **Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6. Continued **research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

7. **Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8. **Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9. **Co-operation among all energy market participants** helps to improve information and understanding, and encourages the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and subsequently abbreviated, this glossary provides a quick and central reference for many of the abbreviations used.

AER	Alternative Energy Requirement.
bcm	billion cubic metres.
BGE	Bord Gáis Eireann.
BPA	Bulk Power Agreement.
CCGT	combined-cycle gas turbine.
CDM	Clean Development Mechanism (under the Kyoto Protocol).
CER	Commission for Energy Regulation.
CHP	combined production of heat and power.
CH_4	methane.
CO_2	carbon dioxide.
CO_2-eq.	CO_2-equivalent.
DCMNR	Department of Communications, Marine and Natural Resources.
DoEHLG	Department of the Environment, Heritage and Local Government.
DSO	distribution system operator.
ESB	Electricity Supply Board.
EU	European Union.
EU-ETS	EU Emissions Trading Scheme.
FRC	full retail contestability.
GDP	gross domestic product.
GHG	greenhouse gas.

GGAP	Greenhouse Gas Abatement Program.
GW	gigawatt, or 1 watt × 10^9.
GWh	gigawatt-hour = 1 gigawatt × 1 hour.
IEA	International Energy Agency.
IPCC	Intergovernmental Panel on Climate Change.
IT	information technologies.
JI	Joint Implementation (under the Kyoto Protocol).
kcal	kilocalorie, or 1 cal × 10^3.
km^2	square kilometre.
kW	kilowatt, or 1 watt × 10^3.
kWh	kilowatt-hour = 1 kilowatt × one hour.
LNG	liquefied natural gas.
LPG	liquefied petroleum gas.
mcm	million cubic metres.
Mt	million tonnes.
Mtoe	million tonnes of oil equivalent; see toe.
MW	megawatt, or 1 watt x 10^6.
MWh	megawatt-hour = 1 megawatt × one hour.
NAP	National Allocation Plan.
NCCS	National Climate Change Strategy.
NDP	National Development Plan.
NERP	National Emission Reduction Plan.
NI	Northern Ireland.
NIAER	Northern Ireland Authority for Energy Regulation.
N_2O	nitrous oxide.
NO_x	nitrogen oxide.
NORA	National Oil Reserves Agency.
OECD	Organisation for Economic Co-operation and Development.
PES	public electricity supplier.

PSO	public service obligation.
PV	photovoltaic.
RA	regulatory authority.
REC	renewable energy certificate.
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well.
SEI	Sustainable Energy Ireland.
SEM	Single Electricity Market.
SO_x	sulphur oxide.
TAO	transmission asset owner.
TFC	total final consumption of energy.
toe	tonnes of oil equivalent, defined as 10^7 kcal.
TPA	third party access.
TPES	total primary energy supply.
TSO	transmission system operator.
TWh	terawatt-hour =1 terawatt x 1 hour.
UNFCCC	United Nations Framework Convention on Climate Change.
VIPP	Virtual Independent Power Producer.
VOCs	volatile organic compounds.

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